TROPICAL DISEASES RESEARCH FUND.

REPORT

OF THE

ADVISORY COMMITTEE FOR THE TROPICAL DISEASES RESEARCH FUND

FOR THE YEAR 1911.

(*For Report for* 1910 *see* [*Cd.* 5514] *February*, 1911.)

Presented to both Houses of Parliament by Command of His Majesty.
February, 1912.

LONDON:
PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE.
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E. PONSONBY, LTD., 116, GRAFTON STREET, DUBLIN.

PRINTED BY
DARLING AND SON, LTD., BACON STREET, E.
1912.

[Cd. 6024.] *Price* 2s. 0d.

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REPORT

OF THE

ADVISORY COMMITTEE

FOR THE

TROPICAL DISEASES RESEARCH FUND

For the Year 1911.

REPORT.

The Advisory Committee for the Tropical Diseases Research Fund was constituted by the Secretary of State for the Colonies in July, 1904, and is now composed as follows :—

The Right Honourable Sir J. West Ridgeway, G.C.B., G.C.M.G., K.C.S.I., P.C., LL.D. (Chairman).
Sir Thomas Barlow, Bart., M.D., K.C.V.O.
Sir John Rose Bradford, M.D., D.Sc., K.C.M.G., F.R.S.
Colonel Sir David Bruce, C.B., F.R.S.
Sir Thomas Holderness, K.C.S.I.
Sir Patrick Manson, M.D., K.C.M.G., F.R.S.
Surgeon-General A. M. Branfoot, C.I.E., I.M.S.
Mr. H. J. Read, C.M.G.
Major Sir Ronald Ross, K.C.B., F.R.S.
Mr. J. A. C. Tilley.
Mr. A. Berriedale Keith, D.C.L. (Secretary).

Sir Charles Lucas, K.C.B., K.C.M.G., Assistant Under-Secretary of State, who had been a member of the Advisory Committee since the date of its inception, resigned his membership on his retirement from the Colonial Office on the 1st of October, 1911. The Committee desire to place on record their appreciation of the unfailing interest which he took in their work and their sense of the great value of his services towards the improvement of the conditions of health in the tropical Colonies of the Empire.

The revenue of the Tropical Diseases Research Fund for the year 1911 was made up as follows :—

Contribution from the Imperial Government	£1,000
Contribution from the Government of India	500
Making a total of	£1,500

Contributions from Dominion and Colonial Governments in the following proportions :—

Commonwealth of Australia	£200	
Southern Nigeria	350	
Gold Coast	200	
Ceylon	100	
Straits Settlements	100	
Federated Malay States	100	
Hong Kong	100	
Trinidad	100	
Jamaica	100	
Fiji	100	
Sierra Leone	100	
The Gambia	100	
British Guiana	100	
British Honduras	50	
Leeward Islands	25	
St. Vincent	20	
Making a total of	—	1,845
In all a total of		£3,345

The expenditure of the year consisted of grants as follows :—

	£	s.	d.
To the London School of Tropical Medicine	£1,533	6	8
To the Liverpool School of Tropical Medicine	1,262	0	0
To the University of London	750	0	0
To the University of Cambridge	250	0	0
Making a total of	£3,795	6	8

The excess of expenditure over income was met by drawing on the accumulated balance of the fund, and the Committee again desire to call attention to the urgent necessity of further sums being placed at their disposal in view of the many important questions calling for further research.

Of the grant to the London School of Tropical Medicine (£1,533 6s. 8d.), £1,000 was expended in respect of the salaries of a teacher and investigator of protozoology and of a teacher and investigator of helminthology, and for the maintenance of the laboratory. The sum of £333 6s. 8d. was expended on the salary of an arthropodologist, and expenditure in connection with his laboratory. These teachers are required, as a condition of the grants which are paid to them from the fund, to devote a portion of their time to research work. The sum of £200 was granted to the School in order to provide an assistant for the Helminthologist so as to relieve him of part of his work and enable him to give fuller attention to questions of research work proper.

Of the grant to the Liverpool School of Tropical Medicine (£1,262) the sum of £1,000 was expended partly in payment of the salaries of the lecturers in economic entomology and parasitology, partly in paying a portion of the salaries of workers in trypanosomiasis and expenses connected with research into that subject. The sum of £262 was granted with a view to the continuation for six months of the following specific scientific researches :—£62 in respect of investigation into amœbic dysentery, £75 in respect of a chemist whose time has been devoted solely to research work, and £125 in respect of research work in malaria.

The grant to the University of London (£750) was expended in paying the salary of a Professor of Protozoology. This post was established in 1906 for a period of five years by means of a grant from the Fund, and in 1911 the Advisory Committee recommended, and the Secretary of State approved, that the grant should be continued for a further period of five years from 1911. The University of London have accordingly reappointed Professor Minchin to the post for the five years from July 1st, 1911.

Of the grant to the University of Cambridge (£250) £100 was paid in respect of the research studentship in medical entomology established in 1907 by means of a grant from the Fund, while £100 was granted on the application of Dr. Nuttall

towards defraying the salary of an assistant in the Quick Laboratory, and £50 for the salary of a Consulting Entomologist. These grants, as in previous years, were made in recognition of the great assistance afforded by Professor Nuttall and the laboratory to workers from the Colonies.

As in 1908, 1909, and 1910, it was not found necessary to make any grant to the Royal Society from the Fund as other provision has been made for the carrying out of the research with regard to sleeping sickness, which is being carried on under the general supervision of the Society.

The Committee were consulted on various matters during the year by the Secretary of State, including the appointment of an assistant in the research laboratory at Yaba, and the selection of an officer to enquire into the diseases of vomiting sickness and peripheral neuritis, which are prevalent in Jamaica.

The Committee append to the report the returns which have been received from certain Colonies and Protectorates in reply to the Secretary of State's circular despatch of the 20th of December, 1910, printed in their last report, asking for further information with regard to mosquito-borne diseases. These returns embody also the anti-malarial measures taken in the different Colonies and Protectorates. The Committee do not comment on these returns as they are not yet complete.

The Committee also append reports of the work done at the London and Liverpool Schools of Tropical Medicine for the year November, 1910, to October, 1911; the report of the Professor of Protozoology at the University of London for the session ended June, 1911; the report of Professor Nuttall on the work done by the Research Student in Entomology at the University of Cambridge and in the Quick Laboratory; and reports on the work done at various Colonial laboratories which have been sent in accordance with the request made by the Secretary of State for the Colonies in December, 1906.

The Committee note with pleasure the high standard of the work which is being done in these laboratories and which shows the increased interest in research work which is being taken by the officers in charge. They are of opinion that the experiment of setting up these laboratories has fully justified itself, and that it deserves all possible encouragement.

WEST RIDGEWAY,
Chairman.

A. Berriedale Keith,
Secretary.
2nd February, 1912.

APPENDIX I.

Reports on Anti-Malarial Measures in the Colonies and Protectorates.

No. 1.

CEYLON.

REPORT BY THE PRINCIPAL CIVIL MEDICAL OFFICER ON THE PREVENTION OF MOSQUITO-BORNE DISEASES.

(Received 24 July, 1911.)

The work in connection with the prevention of mosquito-borne diseases in Ceylon during the year 1910 was on the lines followed in previous years, viz., general improvement in the sanitation of towns, the education of the public by lectures and pamphlets, and the free distribution of quinine.

Malaria is the most frequent form in which a mosquito-borne disease is shown here; the other forms are absent or so rare that they may be disregarded. Malaria, although prevalent, is not a very fatal disease. The deaths from all fevers were ·52 per cent. of the population. The deaths from malaria alone in hospitals were 3·4 per cent. of the admissions for that disease.

As in former years no organised campaign against malaria in any particular town or district has been attempted—but a beginning in this direction has been made by His Excellency the Governor, who, in May, 1910, nominated a Committee, composed of the Honourable Mr. Moonemalle, Dr. Chalmers and Dr. H. M. Fernando, to submit a scheme for the prevention of malaria at Kurunegala, in the North-Western Province. This town has a population of 8,000 persons and covers an area of four square miles. The report was sent in in December, 1910; it estimates the cost for minor works at Rs. 9100/ a year.

I herewith submit the draft return suggested by Professor Ronald Ross, which accompanied his note* to the Advisory Committee on Tropical Research, dated 8th November, 1910.

RETURN of Malarial Fever, Blackwater Fever, Yellow Fever, Filariasis, and Dengue, during the year from the 1st January to the 31st December, 1910.

1. Name of Colony, Ceylon.
2. Total area, 25,331⅝ square miles.
3. Estimated population:—

   (*a*) Total, 4,184,147.†
   (*b*) Europeans, 6,656.
   (*c*)
   (*d*) Other races, 4,177,491.†
   (*e*)

4. Births during the year:—

   Total births, 157,453.

5. Deaths during the year:—

   (*a*) Total deaths, 110,195.
   (*b*) Deaths ascribed to fever, 21,815.
   (*c*) Deaths ascribed to blackwater fever. } No deaths have been recorded from these causes.
   (*d*) Deaths ascribed to yellow fever. }

6. Government hospitals:—

   (*a*) Number of such hospitals, 72.
   (*b*) Totals during year:—

Admissions	61,457
Deaths	7,152

   (*c*) Malarial fever:—

Admissions	7,288
Deaths	249

---

* Enclosure in No. 11 to Appendix I in [Cd. 5514].   † Inclusive of immigrant coolies.

(*d*) Blackwater fever:—

Admissions	Nil.
Deaths	Nil.

(*e*) Yellow fever:—

Admissions	Nil.
Deaths	Nil.

(*f*) Filarial diseases:—

Admissions	20
Deaths	Nil.

(*g*) Dengue:—

Admissions	Nil.
Deaths	Nil.

7. Government dispensaries:—

(*a*) Number of such dispensaries, 335.
(*b*) Total attendances during year, 1,619,532.
(*c*) Attendances for malaria, 508,302.
(*d*) Attendances for filarial diseases, 937.
(*e*) Attendances for dengue, nil.

8. Medical service:—

(*a*) Number of Government medical officers, 276.
(*b*) Number of special health officers, 3.
(*c*) Number of other registered practitioners, 70.

9. Schools:—

(*a*) Number of Government and State-aided schools, 2,656.
(*b*) Number of scholars registered in these schools, .
(*c*) Percentage of daily attendances, .

10. Estates employing unindentured labour:—

(*a*) Number of such, 2,082.
(*b*) Number of unindentured labourers employed, 363,666.
(*c*) Number of hospitals and dispensaries on such estates, 239.
(*d*) Total deaths among such labourers, 127,726.
(*e*) Deaths ascribed to malaria, 668.
(*f*) Total admissions and attendances at hospitals and dispensaries, 173,832.

11. Estimated revenue of Colony:—

Total during year, Rs. 38,124,800.*

12. Estimated expenditure of Colony:—

(*a*) Total during year, Rs. 41,892,488.
(*b*) Annual medical and sanitary expenditure, Rs. 2,606,087.
(*c*) Upkeep of Government hospitals and dispensaries, Rs. 1,566,100.
(*d*) Total salaries and allowances of medical officers, Rs. 882,390.
(*e*) Total annual sanitary expenditure, Rs. 5,281.

13. Towns under municipalities or town councils:—

(*a*) Number of such, 24.
(*b*) Total population, 434,653.
(*c*) Total revenues, Rs. 3,065,413/79.
(*d*) Total medical and sanitary expenditure, Rs. 496,942/54.

14. Table of deaths by districts, *vide* Annexure " A."
15. Table of deaths in the principal towns, *vide* Annexure " B."
16. Rainfall during the year, *vide* Annexure " C."

17. Additional information to be given, if possible, on the following points:—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—Numbers of notices, convictions and warnings during the year, none.

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* From the figures available at present it is anticipated that the actual revenue for the year 1910 will exceed the estimated revenue by Rs. 4,750,000.

(*b*) Number of persons of the age of 15 examined for enlarged spleen,—376,921.

Where was this done?—At the various hospitals, dispensaries and schools.

Percentage affected: spleen rate 19·85.

Does Kala-azar exist?—Kala-azar exists to a very slight extent.

(*c*) Number of persons examined for filarial diseases. Where was this done? percentage affected: As only 23 persons were examined for filarial diseases the percentage would be of no value.

(*d*) Any large works for surface drainage of towns or reclamation of marshes? Approximate cost: none.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost: in only one town a small mosquito brigade was employed for petty anti-mosquito work.

(*f*) Amount of Government quinine sold or distributed gratis during the year, 1,236 lbs. 8 ozs.

Agencies employed: chiefly through the headmen.

(*g*) Is quinine distributed regularly in the schools?—Yes, at 324 out of 731 Government schools.

(*h*) Measures taken against these diseases on estates employing unindentured labour. Free quinine given and improvement in general sanitation in many estates.

(*i*) Any steps taken regarding the housing of the poor?—No.

(*j*) Any exceptional increase or decrease of these diseases recently noticed?—A general decrease in malaria has been recently noticed in the majority of the provinces.

(*k*) Any other remarks on the subject: *vide* introductory remarks.

A. PERRY,

Principal Civil Medical Officer.

Annexure "A."

District.	Area.	Population.* 30th June, 1910.	Population.* 31st Dec., 1910.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total for the Twelve Months.
				Total Deaths in 1910.												
Western Province :																
Colombo	560¾	584,545	587,275	1,319	1,119	1,036	884	1,116	1,239	1,319	1,254	1,138	1,105	1,287	1,358	14,174
Negombo	247½	176,506	177,742	264	234	221	212	373	457	534	496	359	293	307	383	4,133
Kalutara	623¾	259,658	261,448	591	581	599	424	483	486	539	546	463	498	517	541	6,268
Central Province :																
Kandy	911	407,272	409,514	991	882	758	795	828	830	943	1,014	1,078	964	1,015	949	11,047
Matale	925⅝	96,487	97,215	277	286	242	225	256	253	301	279	288	303	262	323	3,295
Nuwara Eliya	462⅞	163,042	163,963	397	260	166	227	284	292	247	232	309	327	420	303	3,464
Northern Province :																
Jaffna	1,265	332,083	334,247	692	617	682	585	583	518	585	789	735	698	696	674	7,854
Mannar	943¼	23,548	23,587	85	90	87	63	76	56	70	83	71	70	78	66	895
Mullaittivu	1,154¾	14,614	14,729	46	34	37	44	45	20	35	52	35	41	46	68	503
Southern Province :																
Galle	652¼	294,680	296,590	699	674	632	546	531	561	587	582	594	597	706	726	7,435
Matara	481¼	235,638	237,848	537	491	491	428	375	374	371	435	435	469	465	503	5,374
Hambantota	1,012¾	110,491	111,114	354	281	307	281	273	299	367	301	272	332	381	392	3,840
Eastern Province :																
Batticaloa	2,871½	159,175	160,376	422	323	316	292	385	263	353	433	408	411	449	279	4,334
Trincomalie	1,165	30,665	30,883	105	66	82	70	73	56	50	54	63	91	97	69	876
North-Western Province :																
Kurunegala	1,844⅞	270,580	272,337	708	520	689	619	710	737	919	943	814	744	694	895	8,992
Puttalam	889¾	28,435	28,481	108	100	102	101	79	67	90	112	90	69	70	66	1,054
Chilaw	262¼	85,321	85,905	141	113	115	106	140	163	179	207	174	135	189	200	1,862
North Central Province :																
Anuradhapura	4,002¼	78,248	79,008	300	266	214	171	154	167	178	207	180	186	207	228	2,458
Province of Uva :																
Badulla	3,154½	192,621	193,405	746	643	486	498	499	661	574	649	594	713	777	687	7,527
Province of Sabaragamuwa :																
Ratuapura	1,259	136,630	136,673	692	544	508	484	574	572	594	525	532	528	571	589	6,713
Kegalla	642	213,332	213,583	706	517	467	459	650	712	869	939	743	724	727	584	8,097
																110,195

* Exclusive of the immigrants whose distribution among the several districts is not known.

Annexure "B."

Towns.	District where situated.	Population estimated to the middle of 1910 by intercensal increase.	Total Deaths in 1910. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	For the Twelve Months.
Western Province.															
Colombo ...	Colombo District ..	187,554	521	467	405	321	438	482	556	542	479	443	540	559	5,753
Negombo ...	Negombo District ...	20,683	30	33	24	24	37	22	26	26	26	31	23	37	339
Moratuwa	Colombo District ...	35,493	83	57	54	39	51	34	44	51	57	70	58	97	695
Kalutara ...	Kalutara District ...	12,127	29	49	42	25	24	27	29	23	31	26	24	19	348
Panadure ...	Kalutara District ...	4,401	18	9	16	8	11	19	18	14	19	12	12	15	171
Central Province.															
Kandy ...	Kandy District ...	30,289	73	71	65	74	72	75	91	93	103	122	91	85	1,015
Gampola ...	Kandy District ...	4,859	15	18	25	18	22	17	20	22	18	33	24	19	251
Nawalapitiya ...	Kandy District ...	4,220	24	21	18	20	19	13	26	28	20	34	24	25	272
Hatton and Dikoya ...	Kandy District ...	3,979	43	19	18	16	22	22	19	27	25	21	19	15	266
Matale ...	Matale District ...	5,776	29	31	26	36	34	42	43	39	39	50	39	61	469
Nuwara Eliya ...	Nuwara Eliya District...	9,054	16	4	12	15	10	7	9	12	9	7	13	12	126
Northern Province.															
Jaffna ...	Jaffna District ...	35,691	114	94	78	82	83	76	89	113	91	110	95	106	1,131
Mannar ...	Mannar District ...	3,338*	13	12	16	9	11	3	11	11	6	5	13	9	119
Mullaittivu ...	Mullaittivu District ...	1,432	7	3	6	7	7	3	4	8	4	4	9	3	65
Vavuniya ...	Mullaittivu District ...	603	2	4	3	6	5	2	5	7	2	3	5	3	47
Southern Province.															
Galle ...	Galle District ...	40,844	146	136	105	106	106	100	121	116	104	98	103	113	1,354
Matara ...	Matara District ...	13,651	37	28	21	29	15	25	29	23	23	16	29	32	307
Weligama ...	Matara District ...	10,720	17	14	17	12	12	12	11	17	17	12	22	15	178
Hambantota ...	Hambantota District ...	3,117	11	8	6	7	7	16	8	11	14	8	10	7	113
Tangalla ...	Hambantota District ...	2,716	7	3	6	10	9	13	6	7	8	5	8	10	92
Eastern Province.															
Batticaloa ...	Batticaloa District ...	10,564	33	17	31	31	33	42	30	44	31	32	22	24	370
Trincomalie ...	Trincomalie District ...	11,295*	39	24	32	34	29	25	18	31	29	27	22	27	337
North-Western Province.															
Kurunegala ...	Kurunegala District ...	8,564	35	42	38	42	51	36	47	39	49	32	27	35	473
Puttalam ...	Puttalam District ...	5,248	16	11	19	22	19	16	11	28	22	13	19	15	211
Kalpitiya ...	Puttalam District ...	1,673	8	5	8	6	5	2	3	3	3	5	6	5	59
Chilaw ...	Chilaw District... ...	4,614	18	21	10	8	15	18	13	16	14	16	19	20	188
North-Central Province.															
Anuradhapura ...	Anuradhapura District	5,241	21	18	17	13	10	25	30	33	20	29	21	17	254
Province of Uva.															
Badulla ...	Badulla District ...	6,910	34	36	22	25	29	33	39	30	36	39	40	41	404
Lunugala ...	Badulla District ...	416†	28	16	22	12	17	12	19	19	17	20	11	16	209
Province of Sabaragamuwa.															
Ratnapura ...	Ratnapura District ...	4,683	49	47	44	42	42	40	45	43	39	56	56	91	594
Kegalla ...	Kegalla District ...	2,638	14	19	17	21	20	26	14	16	25	26	22	21	241
															16,451

* Population of these towns not having been separately enumerated at the Census of 1891, no estimate can be made of the rate of growth in 1901–1910. The population shown is the Census population of 1901 less (in the case of Trincomalie) the military, who are no longer stationed there.

† The population of Lunugala town (as now constituted) was not enumerated at the Census of 1901; the estimate is of the population at the beginning of October, 1907.

Annexure "C."

Rainfall during 1910.

District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Colombo Fort	0·95	1·00	0·84	4·71	2·32	4·20	2·77	0·84	2·15	16·83	5·71	3·37	45·69
Ratnapura	4·44	0·74	5·90	9·44	8·74	17·44	14·08	9·88	15·05	21·03	15·98	5·32	128·04
Puttalam	1·50	0·08	1·32	5·29	0·59	0·07	3·02	1·10	0·21	10·38	8·29	5·23	37·08
Anuradhapura	2·62	1·59	0·00	6·18	2·83	0·89	8·19	4·37	0·15	8·36	10·15	8·48	53·81
Mannar	2·44	1·31	0·35	1·19	0·00	0·00	1·50	7·27	0·11	7·82	8·29	3·06	33·34
Jaffna	1·02	3·58	0·00	0·32	1·88	0·46	3·68	6·12	0·52	4·52	14·18	7·42	43·70
Trincomalee	4·09	2·14	0·00	2·89	1·23	2·61	4·01	4·07	7·91	10·96	19·29	15·58	74·78
Batticaloa	13·92	5·05	0·12	1·19	2·06	1·49	2·90	5·40	2·71	4·88	9·17	21·30	70·19
Hambantota	3·05	2·50	1·60	4·57	1·28	0·75	2·23	0·52	1·87	2·96	4·77	6·81	32·91
Galle	5·96	0·15	5·43	5·07	4·27	14·03	4·33	2·48	5·15	12·80	17·98	3·34	80·99
Kandy	2·38	2·65	0·68	7·94	1·35	6·97	7·11	12·92	6·50	7·76	10·96	13·87	81·09
Hakgala	10·18	3·00	1·14	8·08	1·65	8·61	11·40	4·97	5·69	10·69	20·43	21·31	107·15
Nuwara-Eliya	5·02	4·07	0·74	5·26	0·76	11·80	11·04	8·64	8·68	10·97	14·69	14·67	96·34
Badulla	10·33	2·44	0·44	9·72	5·66	0·91	3·12	4·97	0·80	8·47	11·00	17·87	75·73
Dyatalawa	5·04	2·06	3·02	4·98	4·79	2·10	8·35	8·51	1·42	9·01	11·75	12·74	73·77
Kurunegala	1·37	4·07	0·42	5·18	4·08	6·76	6·59	1·96	2·26	15·07	10·28	9·04	67·08
Colo : Observatory	0·94	0·78	0·40	5·81	3·72	8·43	3·69	0·76	2·29	20·97	7·05	4·83	59·67

No. 2.

HONG KONG.

REPORT FOR THE YEAR 1910 ON THE PREVENTION OF MOSQUITO-BORNE DISEASES.

1. Hong Kong:—

2. Area, island of Hong Kong, 32 square miles.
   ,, Kowloon, 16 square miles.
   ,, New Territories, 356 square miles. (Not included under any of the following statistics—wholly agricultural.)

3. Estimated population:—

Europeans	11,532
East Indians	4,474
Chinese and Malays	330,624
Mixed and coloured	4,345
Total	350,975

4. Births:—

Non-Chinese	300
Chinese	1,233

5.

Total deaths	7,639
Deaths ascribed to malarial fever	591
Deaths ascribed to blackwater fever	0
Deaths ascribed to yellow fever	0

6. (*a*) Government Civil Hospital:—

Total admissions for the year	2,595
Total deaths for the year	147
Malarial fever admissions	340
Malarial fever deaths	5
Blackwater fever admissions	0
Blackwater fever deaths	0
Yellow fever admissions	0
Yellow fever deaths	0
Filarial diseases admissions	1
Filarial diseases deaths	0
Dengue admissions	1
Dengue deaths	0

(*b*) Victoria Hospital (Government):—

Total admissions for the year	331
Total deaths for the year	5
Malarial fever admissions	86
Malarial fever deaths	1
Blackwater fever admissions	0
Blackwater fever deaths	0
Yellow fever admissions	0
Yellow fever deaths	0
Filarial diseases admissions	0
Filarial diseases deaths	0
Dengue admissions	0
Dengue deaths	0

No other Government hospitals (except a small-pox hospital), but there are a few small private hospitals, and also missionary and charitable hospitals supported by voluntary contributions. The most important of these are the Tung Wah Hospital (Chinese), and the Alice Memorial and affiliated hospitals, the returns for which are appended:—

(*c*) Tung Wah Hospital (Chinese)—

Total admissions for the year	4,255
Total deaths for the year	1,333
Malarial fever admissions	602
Malarial fever deaths	186
Blackwater fever admissions	0
Blackwater fever deaths	0
Yellow fever admissions	0
Yellow fever deaths	0
Filarial diseases admissions	0
Filarial diseases deaths	0
Dengue admissions	0
Dengue deaths	0

(*d*) Alice Memorial and Affiliated Hospitals (for Chinese):—

Total admissions for the year	1,253
Total deaths for the year	57
Malarial fever admissions	43
Malarial fever deaths	3
Blackwater fever admissions	0
Blackwater fever deaths	0
Yellow fever admissions	0
Yellow fever deaths	0
Filarial diseases admissions	0
Filarial diseases deaths	0
Dengue admissions	0
Dengue deaths	0

7. There are no Government dispensaries, but there are native (Chinese) dispensaries supported by voluntary contributions, and in charge of Chinese doctors trained in Western medicine. Returns herewith:—

Dispensaries—

(*a*) Number of such dispensaries	8
(*b*) Total attendances during the year (new cases only)	38,210
(*c*) Attendances for malaria (new cases)	3,615
(*d*) Attendances for filarial diseases	1
(*e*) Attendance for Dengue	0

8. Number of Government medical officers	12
Number of special health officers (including two for the port)	4
Number of other registered practitioners (exclusive of military and naval medical officers) ...	26

9. Schools:—

(*a*) Number of Government schools	14
Number of State-aided schools	55

(*b*) Number of scholars registered in Government schools 2,538
Number of scholars registered in State-aided schools 5,336
(*c*) Average daily attendance in Government schools 1,960
Average daily attendance in State-aided schools 4,337

10. Estates employing indentured labour ... ... None.
11. Estimated revenue of the Colony $6,908,797
12. Estimated expenditure of the Colony:—

(*a*) Total $6,951,542
(*b*) Annual medical expenditure 236,546
Annual sanitary expenditure 358,018

Total $594,564

(*c*) Up-keep of Government hospitals:—
Salaries (including Bacteriological Institute) ... $155,783
Up-keep of Government hospitals 78,088
Up-keep of Bacteriological Institute 2,675

Total $236,546

(*d*) Total salaries and allowances of medical officers (including Sanitary Department and Bacteriological Institute) $88,002
(*e*) Total annual sanitary expenditure 358,018

13. No towns under municipalities.

14.—Table of Deaths by Districts.

—	Area in square miles.	Population.		Total Deaths.												
		Chinese.	Non-Chinese.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Victoria ...	4½	180,049	11,376	340	324	352	375	420	584	521	564	511	418	463	370	5242
Peak				—	—	—	—	—	1	1	1	1	—	—	—	4
Villages of Hong-Kong.	27½	18,720	—	34	31	47	45	51	49	57	62	94	59	58	52	639
Kowloon	16	80,200	6,184	123	77	84	101	88	126	116	141	124	118	117	134	1,349
Harbour	—	51,200	3,246	25	20	19	24	31	32	41	52	60	39	30	32	405
Total... ...	48	330,169	20,806	522	452	502	545	590	792	736	820	790	634	668	588	7,639

15. Victoria is the only town, and the figures are given in the foregoing table.

16. Monthly table of rainfall.

Where observed.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in inches.
Kowloon Observatory	0·885	0·405	0·580	3·725	1·955	18·190	13·905	11·155	15·950	0·045	2·535	0·790	70·120

17. (*a*) I attach copies of our bylaw prohibiting the breeding of mosquitoes. During 1910 a large number of notices and warnings were issued to tenants in connection with breaches of this bylaw, and 14 prosecutions were instituted under it, with the result that convictions were obtained in all the cases, and penalties to the amount of $171 were inflicted by the magistrates.

(*b*) The only children examined for enlarged spleen were those treated in the various hospitals. The Chinese of the lower class are so very apt to resent any handling whatever of their children by Europeans that it would probably be only possible to obtain these spleen records through Chinese practitioners trained in Western medicine, and the number of these practitioners is at present so limited, and

the work available for them so extensive, that it may be some time before any detailed investigations can be made in this direction.

Kala Azar is not known to exist in the Colony.

(*c*) There are no records available as to the number of persons examined for filarial diseases alone, but the blood of every patient admitted to a hospital here, whose temperature is above normal, is submitted to microscopical examination, and many of these blood smears are taken between 6 p.m. and 6 a.m.

(*d*) During the year several of the mountain streams, which form anopheles pools, were trained, at a cost of $30,628. This work goes on continuously, a vote being taken each year for the purpose.

(*e*) All the European district sanitary inspectors and the scavenging inspectors (seventeen in number), and also the European rural police, who act as sanitary inspectors in the villages, pay special attention to the prevention of the breeding of mosquitoes in and around dwellings, and there are also small gangs of coolies who are engaged in house to house cleansing work in the native quarters during the morning and spend their afternoons in clearing brushwood in the neighbourhood of dwellings, collecting old pots and other receptacles for water from the hillsides and waste lands, oiling pools, and in other anti-malarial work, under the direction of the European inspectors. About 50 men are employed in this manner, including native foremen.

(*f*) The amount of quinine issued free during the year was as follows:—

Government hospitals	2,300 oz.
Tung Wah hospitals	400 ,,
Alice Memorial and affiliated hospitals	240 ,,
Public dispensaries	712 ,,
Total	3,652 oz.

(*g*) Quinine has not hitherto been distributed in the schools, but it is proposed to institute such method of distribution during 1911.

(*h*) There are no estates employing indentured labour.

(*i*) The question of housing is dealt with very fully by the Public Health and Building Ordinances—a consolidated copy of these Ordinances is attached for reference.

(*j*) Anti-malarial measures were first inaugurated in this Colony in 1899, and the effect of these measures can be gauged from the following table of admissions for malaria to the two large hospitals during the period 1901 to 1910 inclusive.

The following table shows the admissions for malaria to our two largest hospitals during the past ten years:—

Year.	Government Civil Hospital.		Tung Wah Hospital.		Total.		Case-mortality per cent.	
	Admissions.	Deaths.	Admissions.	Deaths.	Admissions.	Deaths.	Government Civil Hospital.	Tung Wah Hospital.
1901	787	10	507	122	1,294	132	1·3	24·1
1902	349	9	403	119	762	128	2·6	29·5
1903	347	2	221	61	568	63	0·6	27·6
1904	221	2	212	56	433	58	0·9	26·4
1905	266	6	153	48	419	54	2·2	31·4
1906	233	7	248	96	481	103	3·0	38·5
1907	247	8	305	87	552	95	3·2	28·5
1908	282	3	355	93	637	96	1·0	26·2
1909	188	1	396	87	584	89	0·5	21·9
1910	340	5	602	186	942	191	1·5	30·9

Only 71 of the 186 deaths at the Tung Wah Hospital during 1910 were admitted under Western treatment, and most of these patients were comatose on admission.

It will be observed that there was a marked increase in the number of admissions for malaria during 1910, and this is attributed by some to increased building activity in districts in which the nullahs had not yet been trained, and by others to a greater uniformity in the rainfall during 1910, that is to say, that there was an almost daily succession of small showers during the rainy season, sufficient to keep the breeding

pools supplied with water, and an absence of heavy rain storms which have the effect of scouring out the many rock pools which constitute the greatest difficulty in regard to anti-malarial measures in this Colony.

Another feature of the Colony which somewhat vitiates our malaria figures is the fact that Hong Kong is in close daily contact with the native Chinese City of Canton and its surrounding country, no less than four thousand Chinese, mostly of the coolie class, passing backwards and forwards between Hong Kong and Canton daily, so that in many cases the malarial infection is not acquired in Hong Kong but in China.

(*k*) Hygiene is taught regularly in all the schools of the Colony, and special attention is paid to the teaching of the manner in which mosquitoes breed and the part played by these insects in the transmission of malaria. Pamphlets on this subject have also been prepared (copies attached), and 2,000 copies of the English version have been distributed to the European inhabitants and to the leading Chinese who read English, while a Chinese translation has also been made, of which it is proposed to distribute 50,000 copies, many of which have already been issued. Lectures are also given by myself to such bodies as the Chinese Y.M.C.A., while paid peripatetic Chinese lecturers are also employed in disseminating information on this and other matters affecting the public health.

FRANCIS CLARK, M.D., M.R.C.P.,
Medical Officer of Health.

March, 1911.

No. 3.

MAURITIUS.

THE ACTING GOVERNOR to THE SECRETARY OF STATE.

(Received 16 September, 1911.)

SIR, Government House, Port Louis, 8th August, 1911.

WITH reference to the despatch noted in the margin,* I have the honour to transmit herewith two copies of a return of malarial fever and other tropical diseases during the year ending 31st December, 1910.

Colonial Office Circular, 20 December, 1910.

2. The resident population (exclusive of the Dependencies) ascertained at the Census made on the 31st March last was 368,510, as stated in Table 14 of the return. As, however, the classification has not yet been made under the divisions indicated in heading 3 of the return, the figures therein inserted show the population under the different groups as estimated on the 31st December, 1910.

I have, &c.,
G. SMITH.

Enclosure in No. 3.

RETURN OF MALARIAL FEVER AND OTHER TROPICAL DISEASES FOR THE YEAR 1910 PREPARED IN ACCORDANCE WITH THE SUGGESTIONS OF PROFESSOR SIR RONALD ROSS.

1. Name of Colony : Mauritius.
2. Total area : 720 square miles.
3. Estimated population on 31st December, 1910 :—

Europeans, whites, mixed, and coloured ...	107,626
Africans	2,270
Indians	259,975
Chinese	4,276
Total estimated population	374,147

4. Total births during 1910 : 13,338.

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* No 11 in Appendix I in [Cd. 5514], February, 1911.

5. Deaths during 1910 :—
   - (*a*) Total deaths : 12,488.
   - (*b*) Deaths ascribed to fever : 4,593.
   - (*c*) ,, ,, blackwater fever : 1.
   - (*d*) ,, ,, yellow fever : Nil.

6. Government Hospitals :—
   - (*a*) Number of such hospitals : 14; including those attached to the jails of the Colony, which number 5.
   - (*b*) Total number of admissions : 18,128.
     ,, ,, deaths : 1,124.

	Admissions.		Deaths.
(*c*) Malarial fever	2,338	...	19
Hypertrophy of spleen (attributed to malaria)	561	...	20
(*d*) Blackwater fever	3	...	Nil
(*e*) Yellow fever	Nil	...	Nil
(*f*) Filarial diseases	41	...	1
(*g*) Dengue	Nil	...	Nil

7. Government Dispensaries :—
   - (*a*) Number of dispensaries : 28.
   - (*b*) Total number of cases treated : 57,889.
   - (*c*) Number of cases of malaria : 19,063.
   - (*d*) ,, ,, ,, filarial diseases : 67.*
   - (*e*) ,, ,, ,, dengue : Nil.

8. Medical Service :—

(*a*) Number of Government medical officers	29
(*b*) Number of special health officers	6
(*c*) Number of other registered practitioners residing in the Colony on 31st December, 1910	24
Total	59

9. Schools :—
   - (*a*) Number of Government and Aided Schools : 149.
   - (*b*) Number of scholars registered in these schools : 20,947.
   - (*c*) Average number of daily attendances : 13,885, or 66.3 per cent.

10. Estates employing indentured labour :—
    - (*a*) Number of such : 104.
    - (*b*) Number of labourers employed : 39,004. (This figure represents the total number of labourers of both sexes employed, whether indentured or not, no distinction being made in that respect in the returns obtained from the Immigration Office.)
    - (*c*) Number of hospitals and dispensaries on such estates : 96.
    - (*d*) Total deaths among such labourers : 2,518.
    - (*e*) Deaths ascribed to malaria : 442.
    - (*f*) Total admissions and attendances at hospitals and dispensaries : 73,637.

11. Estimated Revenue of the Colony for 1910-11 : Rs. 10,354,065.†

12. Estimated Expenditure of the Colony for 1910-11 :—
    - (*a*) Total : Rs. 10,051,482.
    - (*b*) Annual medical and sanitary expenditure :—

Medical and health	Rs. 785,669
Quarantine	14,792
Plague	132,804
Total	Rs. 933,265

* These diseases are believed to be more prevalent than is indicated by that figure.
† The rupee is calculated at 1*s*. 4*d*., or 15 to the £ sterling.

(*c*) Upkeep of Government Hospitals and Dispensaries: Rs. 305,717.*
(*d*) Total salaries and allowances of medical officers: 173,150.
(*e*) Total annual sanitary expenditure: 189,540.*

13. Towns under Municipalities or Town Councils :—
(*a*) Number of such : 4.
(*b*, *c*, *d*) Statement showing total population, total revenues, and total medical and sanitary expenditure :—

Town.	Population.	Revenue.	Medical and Sanitary Expenditure.
		Rs. c.	Rs. c.
Port Louis	41,304	523,494.33	29,233.21
Beau Bassin and Rose Hill	13,574	36,049.14	Definite information could not be obtained on this subject.
Quatre Bornes	6,340	12,847.32	
Curepipe	17,186	92,208.56	

14. Table of deaths, by districts :—

Districts.	Area.	Population.	January.	February.	March.	April.	May	June.	July.	August.	September.	October.	November.	December.	Total.
	Sq. miles.														
Port Louis ...	16	50,025	181	177	188	143	155	165	156	198	190	236	305	247	2,341
Pamplemousses	69	37,386	105	101	107	127	102	118	105	126	106	127	133	76	1,333
Rivière du Rempart.	57½	31,044	57	63	62	85	73	74	89	85	75	56	58	72	849
Flacq	115	51,807	162	119	150	161	193	164	175	166	191	158	137	134	1,910
Grand Port ...	101	49,059	110	93	119	111	122	138	148	167	138	116	153	125	1,540
Savanne ...	93½	33,773	79	65	78	85	83	80	94	77	73	70	94	68	946
Plaines Wilhems	78	67,890	190	132	168	135	151	142	165	131	137	146	159	156	1,812
Moka	89	32,601	102	76	110	106	113	93	98	82	89	92	115	119	1,195
Black River ...	101	14,925	49	39	55	45	34	51	60	43	51	45	48	42	562
Total ...	720	368,510*	1,035	865	1,037	998	1,026	1,025	1,090	1,075	1,050	1,046	1,202	1,039	12,488

* Census figures, 1911.

15. Table of deaths in the principal towns :—

Town.	District where situated.	Population of Town.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Port Louis ...	Port Louis	41,304	139	130	156	125	123	127	121	162	157	171	214	179	1,804
Rose Hill and Beau Bassin.	Plaines Wilhems.	13,574	68	52	52	43	40	41	55	39	46	52	71	60	619
Quatre Bornes	Do.	6,340	3	5	8	3	6	2	4	8	4	4	1	4	52
Curepipe ...	Do.	17,186	38	16	22	22	23	20	15	14	20	18	23	20	251
Total ...	... ...	... ...	248	203	238	193	192	190	195	223	227	245	309	263	2,726

16. Rainfall during the year :—

Where Observed.	District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Royal Alfred Observatory.	Pamplemousses.	7·13	4·00	9·70	2·70	0·44	0·58	4·01	2·52	1·13	1·61	1·73	2·73	38·28
Beau Bassin ...	Plaines Wilhems.	7·32	3·90	7·80	3·71	0·58	0·58	4·63	1·22	0·39	0·81	1·74	8·34	41·52
Curepipe ...	Do.	16·33	11·95	18·07	10·58	2·10	2·07	10·10	4·91	4·93	2·27	2·63	8·11	94·05
Moka	Moka ...	15·87	8·27	18·97	11·51	3·41	2·53	8·70	4·92	5·92	3·01	3·53	10·23	96·87
Mean ...	—	11·66	7·03	13·63	7·1	1·63	1·44	6·86	3·38	3·21	1·92	2·41	7·35	67·68

17.—(*a*) No special legislation in force against the breeding of mosquitoes on premises.

* Exclusive of salaries and wages.

(*b*) Number of children examined for enlarged spleen : 12,724. This was done in the Government and aided schools in all the districts, and the percentage of affected children under 15 years of age was found as hereunder :—

District.	Spleen rate.	Average spleen.
Port Louis	31.7 per cent. ...	2.8
Pamplemousses ...	43.1 „ ...	2.4
Rivière du Rempart ...	20.6 „ ...	1.5
Flacq	43.5 „ ...	2.4
Grand Port	30.3 „ ...	2.0
Savanne	21.4 „ ...	1.4
Black River	52.9 „ ...	3.5
Plaines Wilhems ...	3.4 „ ...	1.2
Moka	12.5 „ ...	1.3

The percentage of school children affected, calculated on the total number of children examined, was 24.0, and the average spleen 2.

From information supplied by the Immigration Office, it follows that owing to the unwillingness of estate labourers to allow their children to be submitted to a spleen examination, the spleen census of children on estates has had to be discontinued.

Kala Azar apparently does not exist in the Colony.

(*d*) Large works for surface drainage and reclamation of marshes :—

Extra Urban area of Port Louis : 941 feet masonry drain with section 2 ft. 6 in. by 1 ft. 6 in. were constructed at Camp Nattou, Roche Bois, at a cost of Rs. 1,200.

941 feet drain, as above, were constructed at the same place (Roche Bois) for Rs. 2,172.

Rural districts : 434 feet drain with section 2 ft. 6 in. by 2 ft. were constructed at Rose Belle at a cost of Rs. 2,032.00.

330 feet drain, as above, were constructed at the same place (Rose Belle), cost : 1,100.00.

Curepipe.—River du Mesnil : 800 feet of the bed of the river were deepened by 6 inches on a width of 2 feet; 640 feet were deepened by 3 feet on a width of 2 feet; and 1,000 feet by 5 feet on a width of 2 feet. Cost : Rs. 2,250.00. The extent of land reclaimed by these works amounted to about 6 acres.

Poule d'Eau River : The course of the river was improved at its source as follows :—Stones were blasted on a length of 1,096 feet to a depth of from 2 feet 6 inches to 8 inches. Earth channels were dug on a length of 463 feet to a depth of from 2 feet to 6 inches. The river was cleaned of mud, stones, &c., on a length of 726 feet. 887 feet of banks were dressed and marshy spaces were filled with earth and stones. Cost : Rs. 330.00.

(*e*) Number of men employed in towns and villages for petty anti-mosquito works :—

——	Moustiquiers.	Labourers.	Total.
Port Louis	1	5	6
Beau Bassin, Rose Hill, and Quatre Bornes ...	1	3	4
Bambous	1	3	4
Phœnix and Camp Fouquereaux	1	6	7
Vacoas	1	6	7
Curepipe	1	6	7
Poudre d'Or	1	3	4
Mahébourg, St. Hubert, and Rose Belle	1	5	6
	8	37	45

Approximate cost : Rs. 13,460 per annum.

(*f*) Amount of quinine sold in 1910 : 12 ozs. 92 grs. Amount of quinine distributed gratis : 215 lbs. 8 ozs. 183 grs.

The drug was distributed from 35 depôts besides the dispensaries.

(*g*) Is quinine distributed regularly in the schools : Fairly regularly.

(*h*) Eighteen estates employing indentured labour have up to now undertaken measures for mosquito reduction. These consist in rough training of all the water courses running in the vicinity of camps or dwelling-houses, draining marshes, filling up pools, making periodical searches for old tins and other receptacles favouring the breeding of mosquitoes, &c.

Quinine is also freely administered to patients attended to in the camps and to children showing enlargement of spleen.

Well-trained moustiquiers are now employed all the year round on six estates, with permanent gangs working under their orders.

(*i*) Any steps taken regarding the housing of the poor : None besides the Building Ordinance which, *inter alia*, prohibits the construction of houses falling short of requirements with regard to ventilation, free admission of light, &c.

(*j*) In April, 1910, malaria broke out in an epidemic form in the localities known as La Dagotiere and Valetta, in the district of Moka. Vigorous measures were taken without delay against the disease. The numerous drains, streams, canals, and other suitable mosquito-breeding places of the infected locality were cleared and cleaned. Quinine was distributed from house to house, about 30 lbs. of the drug being expended during the campaign. As a result of these anti-malarial measures, the number of deaths at La Dagotiere fell from 21 for the first six months of 1910 to six in the second half of the year, and at Valetta from 14 in the first to six in the second half.

L. G. Barbeau,
Acting Director,
Medical and Health Department.

25th July, 1911.

No. 4.

SEYCHELLES.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1st JANUARY TO THE 31st DECEMBER, 1910.

(Received 30 March, 1911.)

1. Name of Colony, Seychelles.

2. Total area, 155 square miles.

3. Estimated population:—
 (*a*) Total, 22,620.
 (*b*) Europeans; 4,000, approximately of European descent.
 (*c*)
 (*d*) Other races.
 (*e*)

4. Births during the year:—
 Total births, 709.

5. Deaths during the year:—
 (*a*) Total deaths, 368.
 (*b*) Deaths ascribed to fever, none under medical certificate.
 (*c*) Deaths ascribed to blackwater fever, one, patient came from Madagascar (landed off a French transport).
 (*d*) Deaths ascribed to yellow fever, nil.

6. Government hospitals:—
 (*a*) Number of such hospitals, one.
 (*b*) Totals, during the year, admissions, 460.
 Totals, during the year, deaths, 30.
 (*c*) Malarial fever, admissions, 3 (all contracted elsewhere).
 Malarial fever, deaths, nil.

(*d*) Blackwater fever, admissions, one, from Madagascar.
Blackwater fever, deaths, one.
(*e*) Yellow fever, admissions, nil.
Yellow fever, deaths, nil.
(*f*) Filarial diseases, admissions, none, as such.
Filarial diseases, deaths, nil.
(*g*) Dengue fever, admissions, nil.
Dengue fever, deaths, nil.

7. Government dispensaries:—
(*a*) Number of such dispensaries, five.
(*b*) Total attendances during the year, 3,106.
(*c*) Attendances for malaria, nil.
(*d*) Attendances for filarial diseases, nil.
(*e*) Attendances for dengue, nil.

8. Medical service:—
(*a*) Number of Government medical officers, four.
(*b*) Number of special health officers, nil.
(*c*) number of other registered practitioners, one.

9. Schools:—
(*a*) Number of Government and State-aided schools, 27.
(*b*) Number of scholars registered in these schools, 2,623.
(*c*) Percentage of daily attendances, 1,999, average attendance.

10. Estates employing indentured labour, nil.

11. Estimated revenue of Colony:—
Total during year 1909, Rs. 496,235; 1910, Rs. 545,000 (approximately).

12. Estimated expenditure of Colony:—
(*a*) Total during year 1909, Rs. 487,872; 1910, Rs. 495,000 (approximately).
(*b*) Annual medical and sanitary expenditure, Rs. 37,840.
(*c*) Upkeep of Government hospitals and dispensaries, Rs. 8,675.
(*d*) Total salaries and allowances to medical officers, Rs. 9,000.
(*e*) Total annual sanitary expenditure, Rs.

13. Towns under municipalities or town councils.

14. Table of deaths by districts:—

District.	Area.	Population.	Total Deaths.												
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Central ...	—	—	19	41	24	30	18	14	20	27	24	25	14	13	269
S. Mahé ...	—	4,890	3	2	1	6	5	3	—	5	6	1	12	4	48
Praslin ...	—	—	5	4	5	3	5	11	6	5	3	1	—	3	51
Total ...	—	—	27	47	30	39	28	28	26	37	33	27	26	20	368

15. Table of deaths in the principal towns:—

No records.

16. Rainfall during the year:—

Where Observed.	District.	Rainfall.												
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Port Office ...	Central ...	13·02	6·45	10·59	10·83	7·61	1·28	1·66	1·51	2·66	0·03	9·00	18·67	83·31
Police Stations	S. Mahe ...	10·06	2·20	7·04	4·70	0·27	0·72	1·13	1·08	1·39	0·17	9·64	6·50	44·90
"	Praslin ...	20·21	3·55	3·78	7·35	5·24	1·38	1·11	1·24	1·80	0·35	8·01	25·54	79·56

17. Additional information to be given if possible. No information can be given.

No. 5.

STRAITS SETTLEMENTS.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM 1ST JANUARY TO THE 31ST DECEMBER, 1910.

(Received October 21, 1911.)

1. Name of Colony: Straits Settlements.
2. Total area: 1,560 square miles.
3. Actual population (Census 1911):—
   (*a*) Total: 714,069.
   (*b*) Europeans: 7,368.
   (*c*) Chinese: 369,843.
   (*d*) Other races: 96,652.
   (*e*) Malays: 240,206.
4. Births during the year:—
   Total births: 18,012.
5. Deaths during the year:—
   (*a*) Total deaths: 27,484.
   (*b*) Deaths ascribed to fever, 5,271 (unspecified); 3,300, malaria.
   (*c*) Deaths ascribed to blackwater fever: Nil.
   (*d*) Deaths ascribed to yellow fever: Nil.
6. Government hospitals:—
   (*a*) Number of such hospitals: 30.
   (*b*) Totals during year: admissions, 33,207; deaths, 4,529.
   (*c*) Malarial fever: admissions, 7,330; deaths, 690.
   (*d*) Blackwater fever: admissions, 1; deaths, Nil.
   (*e*) Yellow fever: admissions, Nil; deaths, Nil.
   (*f*) Filarial diseases: admissions, 5; deaths, Nil.
   (*g*) Dengue: admissions, 14; deaths, Nil.
7. Government dispensaries:—
   (*a*) Number of such dispensaries: 12.
   (*b*) Total attendances during year: 34,660.
   (*c*) Attendances for malaria: 5,135.
   (*d*) Attendances for filarial diseases: Nil.
   (*e*) Attendances for dengue: 32.
8. Medical Service:—
   (*a*) Number of Government Medical Officers: 48, including 24 Assistant Surgeons.
   (*b*) Number of special Health Officers: 2, excluding Municipality.
   (*c*) Number of other registered practitioners: 84.
9. Schools:—
   (*a*) Number of Government and State-aided schools: 218.
   (*b*) Number of scholars registered in these schools: 24,296.
   (*c*) Percentage of daily attendances: 88·7.
10. Estates employing indentured labour:—
    (*a*) Number of such: No figures available.
    (*b*) Number of indentured labourers employed: No figures available.
    (*c*) Number of hospitals and dispensaries on such estates: 10.
    (*d*) Total deaths among such labourers: Not known.
    (*e*) Deaths ascribed to malaria: Not known.
    (*f*) Total admissions and attendances at hospitals and dispensaries: Not known.
11. Estimated revenue of Colony:—
    Total during year: $7,732,657.
12. Estimated expenditure of Colony:—
    (*a*) Total during year: $8,120,840.
    (*b*) Annual medical and sanitary expenditure: $227,071.
    (*c*) Upkeep of Government hospitals and dispensaries: $205,501.
    (*d*) Total salaries and allowances of medical officers: $146,242.
    (*e*) Total annual sanitary expenditure: No annual vote.

13. Towns under Municipalities or Town Councils :—
(*a*) Number of such : 3.
(*b*) Total population : 381,983.
(*c*) Total revenues : $3,779,050.
(*d*) Total medical and sanitary expenditure : $559,374.

14. Table of deaths by Districts :—

District.	Population.	Total Deaths.												Total.
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
Singapore	284,449	863	832	831	878	1,137	1,098	1,361	1,258	1,168	1,095	1,031	959	12,511
Penang	134,343	388	350	351	419	451	394	472	404	451	489	499	451	5,119
Prov. Wellesley ...	123,289	288	243	286	399	330	338	389	444	406	387	338	337	4,185
Dindings	4,657	13	11	18	18	17	8	13	20	26	25	21	24	214
Malacca	98,916	267	296	306	287	341	369	444	481	492	624	638	643	5,188
Labuan	8,199	18	21	20	19	24	16	23	28	27	16	36	19	267
Total ...	...	1,837	1,753	1,812	2,020	2,300	2,223	2,702	2,635	2,570	2,636	2,563	2,433	27,484

15. Table of deaths in the principal towns :—

Town.	Population of Town.	Total Deaths.												Total.
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
Singapore	259,610	770	713	734	734	988	908	1,155	1,051	1,001	927	897	822	10,700
Penang	101,182	302	248	249	320	317	289	328	283	320	371	370	335	3,737
Malacca	21,191	46	58	53	58	66	61	82	82	78	102	94	99	879
Total ...	...	1,118	1,019	1,036	1.112	1,371	1,258	1,565	1,421	1,399	1,400	1,361	1,256	15,316

16. Rainfall during the year :—

Where observed.	Rainfall.												Total.
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
Singapore	6·75	26·05	10·23	11·32	6·59	6·87	5·96	10·93	10·77	11·88	9·76	10·87	127·98
Penang	2·99	5·09	9·72	5·73	11·62	8·45	4·81	11·92	4·87	16·60	21·67	4·98	108·45
Prov. Wellesley	5·64	7·93	9·76	4·70	11·50	10·18	6·55	8·23	4 67	11·94	16·44	8·39	105·93
Dindings	5·51	7·28	5·51	4·57	6·47	4·97	3·18	3·36	7·23	9·52	9·86	11·94	79·40
Malacca	3·32	9·00	6·73	7·42	3·15	6·12	7·18	10·61	4·55	8·34	3·99	6·06	76·47
Total	24·21	55·35	41·95	33·74	39·33	36·59	27·68	45·05	32·09	58·28	61·72	42·24	498·23

17. Additional information to be given if possible on the following points :—
(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Numbers of notices, convictions, and warnings during the year : No.
(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does Kala-azar exist? Nil.
(*c*) Number of persons examined for filarial diseases. Where was this done? Percentage affected : Nil.
(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost : No.
(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost : Unknown.
(*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed : Nil.

(*g*) Is quinine distributed regularly in the schools? No.
(*h*) Measures taken against these diseases on estates employing indentured labour: Nil.
(*i*) Any steps taken regarding the housing of the poor? No.
(*j*) Any exceptional increase or decrease of these diseases recently noticed? 3,300 deaths occurred from malaria, as against 2,589 in 1909 and 3,062 in 1908.

No. 6.

GAMBIA.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM 1st JANUARY TO THE 31st DECEMBER, 1910.

(Received 26 June, 1911.)

1. Name of Colony and Protectorate; Gambia.
2. Total area: Colony, 69 square miles.
   Total area: Protectorate, 4,000 square miles, about.
3. Estimated population:—
   (*a*) Total: Colony, 13,456, 1901 census.
   Total: Protectorate, 76,984, 1901 census.
   (*b*) White, 198.
   (*c*) Africans, 90,206.
   (*d*) Nil.
   (*e*) Nil.
4. Births during the year:—
   (*a*) Total births in Colony, 363.
   (*b*) Total births in Protectorate, no record.
5. Deaths during the year:—
   (*a*) Total deaths in Colony, 385.
   (*b*) Deaths ascribed to fever, 55.
   (*c*) Deaths ascribed to blackwater fever, 2.
   (*d*) Deaths ascribed to yellow fever, nil.
6. Government hospitals:—
   (*a*) Number of such hospitals: 1 general hospital, gaol infirmary, and McCarthy Island dispensary.
   (*b*) Totals during year:—
   Admissions 702
   Deaths 25
   (*c*) Malarial fever:—
   Admissions 106
   Deaths 5
   (*d*) Blackwater fever:—
   Admissions 4
   Deaths 2
   (*e*) Yellow fever:—
   Admissions 0
   Deaths 0
   (*f*) Filarial diseases:—
   Admissions 2
   Deaths 0
   (*g*) Dengue:—
   Admissions 0
   Deaths 0
7. Government dispensaries:—
   (*a*) Number of such dispensaries, 4, including the Protectorate Medical Officer's travelling dispensary.
   (*b*) Total attendances during the year, 10,788 new cases.
   (*c*) Attendances for malaria, 528 new cases.
   (*d*) Attendances for dengue, nil.
   (*e*) Attendances for filarial diseases, 2.

8. Medical service:—
 (*a*) Number of Government medical officers, 4.
 (*b*) Number of special health officers, 1 for Sierra Leone and Gambia.
 (*c*) Number of other registered practitioners, 1.

9. Schools:—
 (*a*) Number of Government and State-aided schools, 8.
 (*b*) Number of scholars registered in these schools, 1,588.
 (*c*) Percentage of daily attendances, 470.

10. Estates employing indentured labour:—
 (*a*) Number of such
 (*b*) Number of indentured labourers employed.
 (*c*) Number of hospitals and dispensaries on such estates.
 (*d*) Total deaths among such labourers.
 (*e*) Deaths ascribed to malaria.
 (*f*) Total admissions and attendances at hospitals and dispensaries.
 } Nil.

11. Estimated revenue of Colony:—
 Total during the year, £79,042.

12. Estimated expenditure of Colony:—
 (*a*) Total during year, £62,754.
 (*b*) Annual medical and sanitary expenditure, £7,923 9s. 10d., including special grant of £1,000 for sanitation.
 (*c*) Upkeep of Government hospitals and dispensaries, £1,996 11s. 11d.
 (*d*) Total salaries and allowances of medical officers and staff, £3,517 5s. 1d.
 (*e*) Total annual sanitary expenditure, £2,409 12s. 10d., including £1,000 special grant.

13. Towns under Municipalities or Town Councils:—
 (*a*) Number of such, 1, Bathurst, under a Board of Health as regards sanitation.
 (*b*) Total population, 8,807, according to 1901 census.
 (*c*) Total revenues; £743 16s. 6d. by rates; £82 11s., slaughter-house fees, grant £450.
 (*d*) Total sanitary expenditure, £1,409 12s. 10d.; excess carried forward to 1911.

14. Table of deaths by districts:—

District.	Area.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Island of St. Mary ...	5 square miles.	8,807	29	21	20	17	23	20	21	31	35	31	29	25	302
Kombo	?	1,641	3	5	4	2	3	4	—	3	2	1	2	6	35
Ceded Mile ...	?	2,211	—	1	2	3	—	—	2	1	—	—	—	1	10
McCarthy Island ...	?	797	2	2	5	2	3	4	6	6	2	1	1	4	38
Total ...	69	13,456	34	29	31	24	29	28	29	41	39	33	32	36	385

15. Table of deaths in the principal towns:—

Towns.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Bathurst	—	8,807	29	21	21	17	23	20	21	31	35	31	29	25	302
McCarthy Island ...	—	797	2	2	5	2	3	4	6	6	2	1	1	4	38
Total ...	—	9,504	31	23	25	19	26	24	27	37	37	32	30	29	340

16. Rainfall during the year:—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Victoria Hospital	Bathurst	—	—	—	—	—	1·15	11·98	16·60	11·52	2·75	—	—	44·00
McCarthy Island Hospital.	McCarthy Island.	—	—	—	—	—	2·88	9·43	10·72	9·86	2·20	—	—	35·09
Total ...	—	—	—	—	—	—	4·03	21·41	27·32	21·38	4·95	—	—	79·09

17. Additional information to be given, if possible, on the following points:—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—No; new Public Health Ordinance is under consideration.

Number of notices, nil.
Number of convictions, nil.
Number of warnings during the year, nil.

(*b*) Number of children examined for enlarged spleen:—

In Bathurst, 375; Protectorate, 100.
Where was this done?—Bathurst and Protectorate.
Percentage affected: Bathurst, 16 per cent.
Percentage affected: Protectorate, 7 per cent.
Does Kala-azar exist?—Not known.

(*c*) Number of persons examined for filarial disease, 2.

Where was this done?—Bathurst.
Percentage affected: 100 of those examined.

(*d*) Any large works for surface drainage of towns or reclamation of marshes, nil.

Approximate cost, nil.

(*e*) Number of men employed in towns and villages for petty anti-mosquito works:—

In Bathurst, 11. Prizes are given in the Protectorate for clean and well kept towns.
Approximate cost: in Bathurst, £170.
Approximate cost: in Protectorate, £113.

(*f*) Amount of Government quinine distributed gratis during the year, 500 ounces.

Agencies employed, dispensaries.

(*g*) Is quinine distributed regularly in the schools?—Yes; weekly, to each scholar by a dispenser.

(*h*) Measures taken against these diseases on estates employing indentured labour, nil.

(*i*) Any steps taken regarding the housing of the poor?—A home for the afflicted and destitute has been built.

(*j*) Any exceptional increase or decrease of these diseases recently noticed?—Yes; the school managers report better attendance and less fever among the school children.

(*k*) Any other remarks on the subject?

The appointment of a European town warden for Bathurst has greatly assisted in clearing the town of old tins and bottles and other refuse.

The new sanitary dustbins and incinerators are an immense success.

The native-made jars, in which water is stored, are the commonest breeding-places for mosquitoes at the present time, and can

only be dealt with effectively by a clause in the Public Health Ordinance making the presence of larvæ an offence.

The grant in aid for the sanitation of Bathurst has been increased from £450 in 1910 to £1,405 for 1911, making a total of £2,157 with the local rates and fees, to be spent on sanitary work.

T. HOOD,
Senior Medical Officer and
Chairman of the Board of Health.

18th May, 1911,
Bathurst,
Gambia.

No. 7.

EAST AFRICA PROTECTORATE.

Answers.

(Received 18 March, 1911.)

1. British East Africa Protectorate.
2. 400,000 square miles (approximate) Drumkey's Year Book, 1909.
3. 2½ millions (approximate).
   (a) —
   (b) 2,500-3,000.
   (c) —
   (d) Asiatics, Goanese, Africans—not known.
4. Not known.
5. Not known.

(As regards 4 and 5 no census has yet been taken, nor is there the machinery available for the notification of births and deaths.)

6. Government hospitals:—
   (a) 10.*
   (b)
   (c)
   (d)
   (e) Statistics for 1910 not yet available.
   (f)
   (g)
7. Government dispensaries:—
   (a) 25.
   (b)
   (c) Statistics for 1910 not yet available.
   (d)
   (e)
8. Medical service:—
   (a) 20 (including two temporary medical officers on sleeping sickness duty).
   (b) 2 (included in 8 (a))
   (c) 12 (to date).
9. Schools:—
   (a) One Government school opened during the year.
   (b) 100.
   (c) —
10. Unknown.
11. £678,888.
12. Estimated expenditure of Colony:—
   (a) £726,885.
   (b) £28,367.†
   (c) £2,010.
   (d) £10,240.
   (e) No special vote.

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* These hospitals refer only to those in charge of a medical officer.

† Includes total estimated expenditure for all purposes connected with the medical departments during the year 1910–1911.

13. Towns under municipalities or town councils:—
 (*a*) One.
 (*b*) (Nairobi), 16,717.
 (*c*) (Nairobi), £5,734.
 (*d*) £1,562.

14. Table of deaths by districts:—
 Not obtainable. Only a fraction comes under the notice of the medical officers.

15. Table of deaths in the principal towns:—
 Statistics for 1910 not available.

16. Rainfall during the year:—
 Not yet available.

17. Additional information:—
 (*a*) Under consideration; a difficult problem, owing to the number and temperament of the tribes and races affected, and the diverse character of the country.
 (*b*) No special record kept. Kala Azar not yet reported.
 (*c*) Test examination carried out at Nairobi Prison. The number worked out, in 200 films from prisoners in Nairobi Jail, at 2.5 *perstans* and 2.5 *nocturna*. Later, in 423 films, 7 cases of *perstans* and one of *nocturna* were noted. Of the cases of *perstans*, 2 were Wakikuyu, 1 Mgaziga, 1 Mswahili, 1 Hybridurat, 1 Mganda, and 1 Nandi. The case of *nocturna* was that of a Yao.

 The Medical Officer, Lamu, in his report for 1910, states that, as far as he has gone at present, over 40 per cent. of the inhabitants of Lamu show filaria in the blood, but his numbers are not yet large enough for an accurate percentage.
 (*d*) None.
 (*e*) 6 men at Mombasa. £80 per annum.
 (*f*) Not yet in a position to estimate amount for 1910.
 (*g*) No.
 (*h*) Unknown.
 (*i*) No poor.
 (*j*) No.
 (*k*) None.

A. D. MILNE.

No. 8.

GOLD COAST.

EXTRACT FROM THE ANNUAL MEDICAL AND SANITARY REPORT FOR THE YEAR 1910.

(Received August 7, 1911.)

Yellow Fever.

In the early part of the year there were 10 cases of yellow fever amongst Europeans in Seccondee, 9 of which were fatal. Three deaths were also known to have occurred amongst natives. The first notified case of the epidemic occurred on the 12th April, and the last death took place on the 22nd May.

On 15th July a death from the same cause was reported from Axim, and on 18th July the last case of the epidemic was brought into Seccondee from 12½ mile camp.

A full report has already been furnished to the Secretary of State of the amounts voted and expended in the different towns, and the preventive measures instituted in each.

I only append therefore a *résumé* of the work done.

Yellow Fever Preventive Measures.

(1) 31 European houses were rendered partly mosquito-proof. Only 2 houses were rendered wholly so.
(2) 34 public wells were made mosquito-proof.
(3) 674 private wells ,, ,,

(4) 133 public tanks were made mosquito-proof.
(5) 815 private tanks ,, ,,
(6) 2,631 barrels ,, ,,
(7) 590 lineal yards of concrete drains were repaired or reconstructed.
(8) 8,608½ lineal yards of new concrete drains constructed.
(9) 6,041 lineal yards ditches dug for drainage.
(10) 4,531,743 square yards grass and vegetation cut.
(11) 664 pools or excavations filled up.
(12) 83,779 square yards marsh land raised and drained (exclusive of Seccondee lagoon).
(13) 2,930 drains oiled.
(14) 2,040 pools oiled.
(15) 22,028 tanks and barrels oiled.
(16) Number of inspectors employed, 41.
(17) Number of houses inspected, 77,096.
(18) Number of houses where larvæ were found, 6,656.
(19) Notices served *re* larvæ, 3,937.
(20) Number fined for having larvæ on premises, 777.
(21) The Cape Coast Town Council passed some excellent by-laws with a view to obtain further powers for dealing with mosquito larvæ, but these were disallowed in deference to the Attorney-General's opinion that they were "ultra vires."
(22) An Ordinance to provide for the destruction of mosquitoes throughout the Colony is at present under the consideration of the Legislative Council.
(23) The total amount voted during the year for yellow fever preventive measures was £9,030 15s 6d.

The approximate expenditure in the different stations is tabulated below:—

EXPENDITURE ON YELLOW FEVER PREVENTIVE MEASURES DURING 1910.

	Amount Expended on Extra Labour Employed.	Amount Expended on Extra Sanitary Inspectors.	Amount Expended for Fumigation.	Amount Expended for Mosquito Proofing.	Amount Expended for Constructive Work.	Other Measures.	Total.
	£ s. d	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Accra	—	—	—	—	—	—	1,294 1 3
Winnebah	343 15 6	—	—	15 15 11	80 1 11	32 1 0	471 14 4
Saltpond	80 11 9	37 10 0	—	154 4 4	—	135 15 4	408 1 5
Cape Coast	179 2 4	60 0 0	—	15 7 6	—	285 5 1	539 14 11
Elmina	135 11 3	16 13 4	—	56 3 11	—	—	208 8 6
Seccondee	1,408 15 4	58 9 9	302 13 0	219 8 1	1,233 2 3	36 17 8	3,259 6 1
Axim	449 11 10	36 2 6	10 16 0	94 14 1	111 12 1	31 6 0	734 2 6
Quittah	16 16 9	—	—	20 6 0	—	—	37 2 9
Tarquah	71 9 0	20 10 3	—	—	—	1 10 0	93 9 3
TOTAL ... £	2,685 13 9	229 5 10	313 9 0	575 19 10	1,424 16 3	522 15 1	7,046 1 0

FILARIASIS.

Only 6 cases of elephantiasis were reported under treatment during the year. There were 3 cases of Filaria Loa recorded.

Although it cannot be said that any special preventive measures have been set on foot with reference to this disease in particular, still the fact has not been lost sight of that the prevention of Filariasis practically resolves itself into protection from mosquito bite.

A rigorous campaign against mosquitoes of every variety is at present being conducted.

RECOMMENDATIONS FOR FUTURE WORK.

1. *Mosquito brigades.*—The interest taken by Europeans, more especially non-officials, has not been encouraging.

One or two refreshing outbursts of zeal in this direction have been witnessed, but they seem to have died a speedy natural death.

The interest displayed by the native may be written down as nil.

This being so, it is hopeless, for the present at any rate, to expect to derive much good from voluntary brigades.

Brigades of the necessary strength must be maintained in all the principal towns, and the necessary sums for this must be voted.

Funds were available during the latter half of the year from the Yellow Fever Preventive Vote and a large amount of work was done in the anti-mosquito crusade. Stegomyia index in some places was reduced as low as 1 and 2 per cent., and anopheles practically banished. It will be a great pity to let things revert to their former state, which they most certainly will unless the necessary funds are forthcoming.

In Accra, for example, during November and December the Town Council had not the funds to maintain a mosquito brigade.

Unless the necessary steps are taken to prevent it, it is quite possible that such a thing may again occur when we have no Yellow Fever Vote to fall back on.

2. The *drainage of the swamps* in and around the large towns should be taken in hand. I recognise that this is a big job, and beyond the resources of the Colony to tackle all at once, but I suggest that a reasonable sum be voted annually for "drainage of swamps," and the work gradually proceeded with.

3. *Quinine* should be distributed gratis, and I make the rather radical suggestion that it should be made compulsory for school children and the children of officials to take, say, their bi-weekly dose.

4. I suggest that malarial patients be carefully isolated, and that the *fumigation* of malaria-infected houses be made compulsory.

5. *Education of the native* as to the vital importance of the mosquito and other insects in conveying disease requires more attention.

The attempts in this direction in the past have not, I admit, been encouraging, but if funds are obtainable to make the subject a more interesting one, and to print simple pamphlets in the commonest native languages for general distribution, in addition to the instruction given in schools, then perhaps some headway might be made.

6. Although it is considered that not much good is likely to accrue, at the present, from the compulsory isolation of sleeping sickness cases, still I am of opinion that more stringent measures should be adopted towards chiefs, making it compulsory on them to *notify cases* of this disease in their districts.

7. More stringent legislation should be introduced, imposing on chiefs the obligation of clearing round their villages, water supplies, &c. *Special inspectors* should be appointed to continually inspect these clearings, and see that they are kept as they should be.

8. All *native hospitals* in the Colony should be made mosquito-proof, unless it can be proved that the district is fly and mosquito free.

9. I suggest that some weight be brought to bear on the employers of white labour in the Colony, with reference to the *segregation* of their employees.

It may not be advisable to introduce any legislation making the segregation of whites compulsory, but the heads of firms and others ought to be very distinctly made to understand their moral responsibility in this matter.

10. It is of vital importance that the *water supplies* of the larger towns should be protected against surface contamination with the least possible delay, and it would be an improvement were a large number of the existing wells converted into wells of the Macgregor type.

Some work is being done in this direction, but the matter is so important that the work ought to be pushed to completion with the utmost despatch, at the expense of other work if necessary.

No. 9.

SOMALILAND.

(Received 4 March, 1911.)

1. Name of Colony.—Somaliland Protectorate, North-East Africa.
2. Total area.—68,000 square miles.
3. Estimated population.—Total, 300,000.

    (*b*) European, 20.
    (*c*) Indian, 200.
    (*d*) Arabs, 300.
    (*e*) Mixed, 100.
    (*f*) Somalis, 300,000.

4. Births during the year.—Total births, unknown.
5. Deaths during the year.—
   (*a*) Total deaths, about 300, known.
   (*b*) Deaths ascribed to fever—One.
   (*c*) Deaths ascribed to Blackwater fever—Nil.
   (*d*) Yellow fever—Nil.

6. Government Hospitals.—
   (*a*) Number of hospitals—Three.
   (*b*) Total admissions during the year—347.
   „ deaths „ „ 9.
   Not included in the above.—
   Smallpox Camp Hospitals, three.
   Admissions—698.
   Deaths—139.
   (*c*) Malarial fever—Admissions, 91; death, 1.
   (*d*) Blackwater fever—Nil.
   (*e*) Yellow fever—Nil.
   (*f*) Filarial diseases—Nil.
   (*g*) Dengue—Nil. (No epidemic, possibly a few cases wrongly diagnosed as rheumatism.)

7. Government Dispensaries.—
   (*a*) Number of such dispensaries—One attached to each of the three hospitals
   (*b*) Total attendances during the year—23,151.
   (*c*) Attendances for malaria—1,155.
   (*d*) „ „ Filarial diseases—Nil.
   (*e*) „ „ Dengue—Nil.

8. Medical Service.—
   (*a*) Number of medical officers—Two.
   (*b*) Number of Special Health Officers—None.
   (*c*) Number of other registered practitioners—Three Government qualified hospital assistants.

9. Schools.—
   (*a*) Number of Government State-aided schools—Three; the teaching being in reading and writing Arabic.
   (*b*) Number of scholars registered in these schools—

Berbera	114
Bulhar	450
Zeyla	41

   (*c*) Percentage of daily attendances—

Berbera	94
Bulhar	28
Zeyla	6

10. Estates employing indentured labour.—
   (*a*), (*b*), (*c*), (*d*), (*e*), (*f*)—Nil.

11. Estimated revenue of the Colony.—Total during the year—£22,500.

12. Estimated expenditure of Colony.—
   (*a*) Total during year—£36,600.
   (*b*) Annual Medical and Sanitary expenditure—
   (*c*) Upkeep of Government Hospitals and Dispensaries—£15 6s. 4d.
   (*d*) Total salaries and allowances to medical officers—£1,070.
   (*e*) Total annual sanitary expenditure—

	£	s.	d.
Conservancy sweepers	£822	1	0
Drainage	2	16	0
Covering of tanks with gauze ...	20	0	0
Ventilation	2	6	0

13. Towns under municipalities or town councils.—
   (*a*), (*b*), (*c*), (*d*)—Nil.

14. Table of deaths, by districts.—

District.	Area.	Population.	Total Deaths.											
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Square Miles.													
Berbera ...	900	40,000	1	—	—	—	—	1	1	—	2	—	14	120
Bulhar ...	300	15,000	—	—	—	—	—	—	—	—	—	—	—	2
Zeyla ...	900	30,000	—	1	—	—	—	—	—	—	2	—	—	—

Total deaths—144.

15. Table of deaths in the principal towns.—The above are the only certain figures available, and are taken from hospital admissions. No official record of deaths among the native population are taken or could be easily obtainable.

16. Rainfall during the year.—

Where observed: District.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Town of Berbera	·02	—	5·78	—	·20	—	—	·30	—	—	—	—
Town of Zeyla	·17	—	2·47	—	—	—	—	—	—	—	—	·60

Total for the year—Berbera, 6.30; Zeyla, 3.24.

17.—(*a*) No actual legislation on this subject is in force. By request, persons other than Government servants are generally induced to take measures where required.

(*b*) Number of children examined for enlarged spleen.—No exact numbers have been kept on record, but in the routine examination of children brought to hospital for treatment, it is exceptional to meet with a case. No diagnosed cases of Kala-azar have been met with.

(*c*) No cases were seen during the year.

(*d*) £20 has been devoted during the last year to reclamation of low-lying foreshore. To the above sum may be added the value of some free labour and material. No marshes exist.

(*e*) Nil.

(*f*) Quinine is distributed free to all persons applying for it at the Government Hospitals. Amount for year, 10¾ lbs.

(*g*) No; no regular schools exist.

(*h*) Nil. There are no estates of any kind.

(*i*) The natives are entirely nomadic; the poor are provided with a small cash dole from municipal funds to purchase food. They have little or no desire to reside in any house, preferring a light, temporary structure of grass or hair mats.

(*j*) No.

(*k*) The desert and waterless condition of the country protects the population in a remarkable way. Very few diseases seem able to obtain any hold among a population living almost entirely on milk and meat only. The following notes may be of interest: The small dress is of cotton only. No woollen garments are worn except discarded European clothing, as a rule. Blankets are never purchased, even the cheapest. Neither alcohol nor tobacco is indulged in by the Somalis. Tea is taken, but not coffee—or, if taken, the husk alone is used—this being considered too heating.

Fish, of which an abundance of good varieties may be caught on the coast, is seldom, if ever, eaten.

Rice as a food is of modern introduction and, with dates, is now extensively imported.

A. J. M. PAGET, M.D., &c.,
Senior Medical Officer.

No. 10.

SOUTH AFRICA.

THE HIGH COMMISSIONER to THE SECRETARY OF STATE.

(Received 18 March, 1911.)

SIR, Government House, Cape Town, March 1st, 1911.

WITH reference to your circular despatch of December 20th, 1910,* I have the honour to enclose, for your information, a copy of the undermentioned documents on the subject of the prevention of mosquito-borne diseases in the tropical Colonies and Protectorates.

I have, &c.,
GLADSTONE,
High Commissioner.

SCHEDULE OF ENCLOSURES.

January 30th, 1911.	Despatch from Resident Commissioner, Mafeking.
February 2nd, 1911.	Despatch from Resident Commissioner, Mbabane.
February 3rd, 1911.	Despatch from Acting Administrator, Livingstone.
February 6th, 1911.	Despatch from Administrator, Salisbury.

Enclosure 1 in No. 10.

MY LORD, Resident Commissioner's Office, Mafeking, 30th January, 1911.

WITH reference to your despatch of the 19th instant, enclosing a copy of a circular despatch from the Secretary of State on the subject of the prevention of mosquito-borne diseases, I have the honour to inform Your Excellency that, so far as the Bechuanaland Protectorate is concerned, it would be impossible to obtain statistics of any value under the heads mentioned in the annexure to Professor Ross's note.

I have, &c.,
F. W. PANZERA,
Resident Commissioner.

His Excellency
The High Commissioner,
Cape Town.

Enclosure 2 in No. 10.

Resident Commissioner's Office,
MY LORD, Mbabane, Swaziland, February 2nd, 1911.

I HAVE the honour to acknowledge the receipt of Colonial Office circular, dated January 6th, covering a copy of the revised note by Professor Ronald Ross, on the prevention of mosquito-borne diseases in the Colonies, to be substituted for those forwarded with the Secretary of State's circular despatch of December 20th, 1910.

I have, &c.,
R. T. CORYNDON,
Resident Commissioner.

The Right Honourable
Viscount Gladstone, P.C., G.C.M.G.,
High Commissioner for South Africa.

Enclosure 3 in No. 10.

Administrator's Office, Livingstone,
MY LORD, North-Western Rhodesia, 3rd February, 1911.

I HAVE the honour to acknowledge the receipt of your Lordship's despatch of the 19th ultimo, transmitting a copy of a circular despatch from the Secretary of

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* No. 11 in Appendix I in [Cd. 5514].

State on the subject of the prevention of mosquito-borne diseases in the tropical Colonies and Protectorates.

2. I will endeavour to arrange to supply the annual statistics required by the Secretary of State, but accurate information as to the incidence of the various diseases is not available, as a large number of cases do not come under the notice of medical officers. This is especially so with regard to malarial fever, which disease is very often treated without medical advice. Some indication of the general health and incidence of disease may, however, be gained from the number of cases admitted to the hospitals, and the Principal Medical Officer has been instructed to prepare as accurate a return as possible.

I have, &c.,
L. A. Wallace,
Acting Administrator.

His Excellency
The High Commissioner,
Cape Town.

Enclosure 4 in No. 10.

My Lord, Administrator's Office, Salisbury, 6th February, 1911.

I have the honour to acknowledge the receipt of your Lordship's despatch of the 19th January, forwarding a copy of a circular despatch from the Secretary of State on the subject of the prevention of mosquito-borne diseases in the tropical Colonies and Protectorates.

In reply, I have the honour to transmit copies of reports on public health for the past two years which contain the bulk of the information desired as regards this territory, and have arranged that in future a manuscript copy of the portion of this Report dealing with the prevention of mosquito-borne diseases be prepared annually for transmission to you in advance of the printed reports.

I have, &c.,
W. H. Milton,
Administrator.

His Excellency
The High Commissioner,
Cape Town.

Extract from Medical Report on Southern Rhodesia.

Prevalence of Principal Diseases.

Europeans.

There has been a marked falling off in the number of cases of malaria, 706 cases being treated in hospitals during 1910 as compared with 1,190 cases in 1909. The decrease has been general throughout the territory, and was no more marked in one district than in another. The District Surgeons in their reports have all drawn attention to the general decrease of malaria this year, which they ascribe to the smallness and nature of the rainfall. By far the greatest amount of sickness in rural districts is due to this cause and its complications, and it must be admitted that, in spite of all that has been taught and written, the settlers in the outside districts, whether farmers, miners, or engaged in other pursuits, still remain as a class woefully indifferent to the effects of this disease, and do little to prevent its occurrence. Not only are they remiss as regards themselves, but they appear to take little care of their children, and the presence of

malaria amongst the young in rural districts cannot but have a serious effect on their development, and an important bearing on the beneficial occupation of the country. The pity of it is that the majority of these people, whether newcomers or old hands, have in other countries been accustomed to take ordinary precautions against the diseases and troubles incidental to the country, or have been compulsorily safeguarded by legislation, and yet, on coming to a sub-tropical country, they cannot or will not recognise that in their new homes they must equally have problems governing the public health which it is their duty to overcome. Pamphlets dealing with the cause and prevention of malaria and blackwater fever have been widely distributed by the various Government Departments, and elementary teaching in the diseases peculiar to the country, and tropical hygiene generally, is provided in all Government schools. Townships are, on the whole, well situated and well drained, and, with perhaps the exception of Victoria, the inhabitants of these suffer little, the general rule being that the malarial incidence is in reverse ratio to the age of the town and the number of the inhabitants. There is little or no necessity, therefore, for the enforcement of anti-malarial precautions in our large towns by Municipalities or Sanitary Boards, though the same does not apply to small settlements in rural districts. The class, however, which suffers most is the farmers, prospectors, and miners, living on lonely farms and mines, and as mosquito crusades, extensive drainage schemes, &c., as carried out by governments and local authorities, can only in practice be applied to communities, this class must be left to work out its own salvation, though assisted in every way by education and advice.

There were 37 deaths from blackwater fever, of which 35 were amongst Europeans. 75 cases were treated in general hospitals, with 17 deaths, or a mortality of 22·66 per cent. There has been little or no diminution in the number of cases during the year, in spite of the low malaria incidence, though the mortality is somewhat lower. Blackwater is certainly one of the chief causes of mortality in malarial infections, and it might be enormously decreased, if not altogether prevented, were ordinary precautions taken for the prevention or early treatment of malarial attacks.

Table I.

Cases, with death rate per cent., of Malarial Fever admitted to hospitals in 1910, as compared with 1909.

—		1909.			1910.		
		Cases.	Deaths.	Death rate per cent.	Cases.	Deaths.	Death rate per cent.
Salisbury	White	233	4	1·72	188	4	2·12
	Native	38	—	—	51	1	1·96
Umtali	White	264	—	—	124	1	·81
	Native	12	—	—	2	1	50·00
Gwelo	White	133	1	·75	57	—	—
	Native	19	—	—	15	1	6·66
Victoria	White	45	1	2·22	17	—	—
	Native	2	—	—	2	—	—
Hartley	White	168	1	·60	59	—	—
	Native	27	—	—	14	—	—
Gwanda	White	40	—	—	22	—	—
	Native	4	—	—	11	—	—
Enkeldoorn	White	6	—	—	12	—	—
	Native	2	—	—	2	—	—
Gatooma (Native) ...	Native	7	1	14·29	6	1	16·66
Bulawayo	White	301	4	1·33	171	2	1·17
	Native	89	1	1·12	106	2	1·89
Abercorn*	White	—	—	—	40	1	2·50
Sinoia*	White	—	—	—	8	—	—
Mazoe*	White	—	—	—	8	—	—
Totals ...	White	1,190	11	·92	706	8	1·13
	Native	200	2	1·00	209	6	2·87

* For Europeans only.

TABLE II.

Cases, with death rate per cent., of Hæmoglobinuric Fever admitted to hospitals in 1910, as compared with 1909.

—		1909. Cases.	1909. Deaths.	1909. Death rate per cent.	1910. Cases.	1910. Deaths.	1910. Death rate per cent.
Salisbury	White	13	5	38·46	21	3	14·28
	Native	—	—	—	—	—	—
Umtali	White	11	1	9·09	11	3	27·27
	Native	1	—	—	—	—	—
Gwelo	White	8	1	12·50	—	—	—
	Native	—	—	—	—	—	—
Victoria	White	8	1	12·50	10	1	10·00
	Native	—	—	—	—	—	—
Hartley	White	16	6	37·50	8	4	50·00
	Native	1	—	—	1	—	—
Gwanda	White	2	2	100·00	2	—	—
	Native	—	—	—	—	—	—
Enkeldoorn	White	1	—	—	1	—	—
	Native	—	—	—	—	—	—
Gatooma (Native) ...	Native	—	—	—	—	—	—
Bulawayo	White	16	2	12·50	9	1	11·11
	Native	1	1	100·00	—	—	—
Abercorn*	White	—	—	—	8	4	50·00
Sinoia*	White	—	—	—	4	—	—
Mazoe*	White	—	—	—	1	1	100·00
Totals ...	White	75	18	24·00	75	17	22·66
	Native	3	1	33·33	1	—	—

* For Europeans only.

No. 11.

SOUTH AFRICA.

THE HIGH COMMISSIONER to THE SECRETARY OF STATE.

(Received September 23, 1911.)

(Extract.)

High Commissioner's Office, Pretoria,
September 4th, 1911.

SIR,

I HAVE the honour to enclose for your information a copy of a despatch from the Acting Resident Commissioner, Bechuanaland Protectorate, on the subject of the report of the Advisory Committee for the Tropical Diseases Research Fund for the year 1910.

I have, &c.,
GLADSTONE,
High Commissioner.

Enclosure in No. 11.

Resident Commissioner's Office, Mafeking,
August 23rd, 1911.

MY LORD,

WITH reference to my despatch of the 13th of June last, I have the honour to enclose a copy of a minute from Dr. MacRae, Medical Officer to this Administra-

tion, containing his observations on the report of the Advisory Committee for the Tropical Diseases Research Fund for the year 1910.

I have, &c.,
BARRY MAY,
Acting Resident Commissioner.

His Excellency
The High Commissioner,
Pretoria.

THE GOVERNMENT SECRETARY, Mafeking,

I HAVE read the report of the Advisory Committee for the Tropical Diseases Research Fund for the year 1910; and, in accordance with your request, subjoin such remarks as appear to be called for in the Secretary of State's circular despatch, 15th of March, 1911, paragraph 2; these remarks being based upon what obtains, and what is possible or otherwise, in dealing with malarial fever in this Protectorate.

The difficulties set forth by the report in adopting measures suitable to the requirements of large native communities are such as here constitute, it seems to me, an insurmountable barrier to any scheme of promise, in prophylaxis or treatment: the territory is so vast, and its institutions are so primitive, that any scheme of universal medical treatment would be utterly incompatible, as you are aware, with the power and the means which exist. It would not only be necessary to provide a large medical establishment, but also a relative increase in the executive.

In a sanitary point of view—as in many other matters—to have been through the native villages in some parts of the Protectorate is truly "to have lived with Menes; it is to have watched the dawn of evolution." To undertake to deal with this alone would involve an expenditure beyond anything which can, probably, be reasonably or economically looked for from the resources of the country—even remotely; and therefore the efforts towards gratuitous treatment of natives have, hitherto, been confined to the issuing of quinine, Peruvian bark, and other drugs to the various mission stations.

The measures adopted in the Protectorate, as regards prevention and treatment, are confined to the Service; and their good results have been for a considerable time, quite manifest. The clearing of bush, the introduction of mosquito-proof quarters, the attention to general cleanliness—all these have, to a large extent, rid Gaberones of the mosquito pest which made life on the station some eight or twelve years ago "one long disease," while the free and persistent use of quinine and Peruvian bark for the past eight years has completely changed the physical and mental tone of the service—of all ranks. It is a rare thing to see or hear of a serious case of fever now—unless from one of the remote outstations. At one time the mortality at Gaberones is said to have been very high; and, making allowance for powerful and adventitious or contributory causes, probably with good reason. Now, death from fever, *per se*, would be scarcely credible; the writer has no knowledge or recollection of such an event in the service within the last eight years. And the attacks, when they do occur, are generally so mild that a few doses of quinine suffice for their dispersion, that is, those who have been accustomed to its use.

The malaria prevalent south of N'gamiland—speaking roughly—is of the Roman Campagna types—tertian and quartan. It assumes a severe bilious form at times and, neglected, is capable of developing a very serious or even fatal character. Death, however, is, as a rule, the result of attacks occurring and prolonged over many years and rather due to secondary or intercurrent troubles. Great depression and even acute melancholia and mania are not infrequent post-malarial symptoms in this country.

Hydrobromic acid is the solvent *par excellence* for sulphate of quinine; and, when the latter drug is to be administered in solution, in doses of 5 to 10 grains, should be invariably selected. The destructive effects of some of the mineral acids upon the teeth is familiar in most malarial countries; and much of the prejudice

arising from the use of quinine in times past had its origin in this. Hydrobromic acid, in addition to being less corrosive (excepting phosphoric, citric, and tartaric acids, whose solvent powers are relatively less), has the general sedative properties of the bromides—a most important factor in the acute stages of fever, where there is not only pain and restlessness, but great nervous and mental disturbance; it can be given in doses large enough to ensure the solution of 5 to 10 grains of quinine; and, lastly, it is a powerful corrective to the unpleasant effects of quinine—known as "chinchonism." Beginning with 10 grains of quinine in tabloid form and 10 grains of phenacetin the writer has never seen a case of fever where the action of the following combination was not almost magical:—

R. Quin. Sulph.	grs. 5
A. C. Hydrobrom dil.	m. 20 to 25.
Tinct. Opii	m. 5 to 10
Aq. ad.	

Sig: every two, three or four hours in water. After the first 24 or 48 hours the opium may be replaced by strychnine, or the treatment continued by tabloids; or at a later stage where a smaller dose of quinine is sufficient and the treatment by solution desirable phosphoric, citric, or tartaric acids may be advantageously used.

Peruvian bark, as tinct. cinch co., has the advantage of being free from acid; it has a preservative rather than a destructive action upon the teeth; it can be given in alcohol, and, in this form, relied upon not only to captivate the heart but to improve the understanding of the most sceptical and hardened "old coaster," whose conversion is a matter of considerable importance, both to the service of [? and] the public. The "bark and wine" of the old physicians is not only a remedy of the first order, in most exhausting or debilitating conditions, but of absolute curative power; and that power is never more marked than in malaria and diseases occurring consequent upon or in association with it.

Finally, it can be given, in combination with mercury and iodide of potassium, where, whilst exercising its anti-malarial action, its power as a tonic and germicide is at the same time directed against the syphilitic virus.

D. MacRae,
Medical Officer,
Bechuanaland Protectorate Government.

Gaberones,
Bechuanaland Protectorate,
August 15, 1911.

No. 12.

SOUTHERN NIGERIA.

The ACTING GOVERNOR to the SECRETARY OF STATE.

(Received 18 September, 1911.)

Sir, Government House, Lagos, Southern Nigeria, 29th August, 1911.

With reference to the 3rd paragraph of your circular despatch of the 20th December, 1910,* under cover of which was transmitted copy of a note prepared by Sir Ronald Ross on the subject of the prevention of mosquito-borne diseases in the Colonies, I have the honour to enclose herewith the return attached to Sir Ronald Ross's note filled in to the best of the Senior Sanitary Officer's ability.

2. I would observe in connexion not only with the return in question, but with all returns of a similar nature, that although a certain amount of information is available it is not always available in the prescribed tabular form so as to enable satisfactory statistics or accurate details to be furnished at comparatively short notice; this is due to the fact that it requires some little time for instructions as to the compilation of statistics in any particular form to be carried into effect by medical and other officers throughout the various stations in the Colony and Protectorate.

* No. 11 in Appendix I in [Cd. 5514].

The Acting Principal Medical Officer, however, informs me that instructions have, in this instance, been duly issued, and it is hoped that Sir Ronald Ross's return in respect of the year 1911 will be rendered in more complete a form than is the one enclosed in respect of the year 1910.

3. Meanwhile, it is proposed to furnish the above statistics annually as requested in your despatch under reference.

I have, &c.,
A. G. BOYLE,
Acting Governor.

Enclosure in No. 12.

RETURN of Malarial Fever, Blackwater Fever, Yellow Fever, Filariasis, and Dengue during the year from the 1st January to the 31st December (1910).

1. Name of Colony.—Southern Nigeria.
2. Total area.—77,260.
3. Estimated population :—
   (*a*) Total.—7,835,483.
   (*b*) Europeans.—1,648.
   (*c*) Asiatics.—99.
   (*d*) Other races. West Africans.—7,833,249.
   (*e*) Non-West Africans (coloured).—487.
4. Births during the year :—
   Total births.—2,651; Lagos and Ebute Metta only.
5. Deaths during the year :—
   (*a*) Total deaths.—2,262; Lagos and Ebute Metta only.
   (*b*) Deaths ascribed to fever.—551; Lagos and Ebute Metta only.
   (*c*) Deaths ascribed to blackwater fever.—8.
6. Government Hospitals :—
   (*a*) Number of such hospitals.—12.
   (*b*) Totals during year.—Admissions, 7,145; deaths, 427.
   (*c*) Malarial fever.—Admissions, 3,751; deaths, 17.
   (*d*) Blackwater fever.—Admissions, 35; deaths, 8.
   (*e*) Yellow fever.—Admissions, —; deaths, —.
   (*f*) Filarial diseases.—Admissions, 123; deaths, 1.
7. Government dispensaries :—
   (*a*) Number of such dispensaries.—36.
   (*b*) Total attendances during year.—45,308.
8. Medical Service :—
   (*a*) Number of Government Medical Officers.—75.
   (*b*) Number of special Health Officers.—3.
   (*c*) Number of other registered practitioners.—9.
9. Schools :—
   (*a*) Number of Government and State-aided schools.—161.
   (*b*) Number of scholars registered in these schools.—19,573.
   (*c*) Percentage of daily attendances.—69.
10. Estates employing indentured labour.—None.
11. Estimated revenue of Colony :—
   Total during year.—£1,558,681.
12. Estimated expenditure of Colony :—
   (*a*) Total during year.—£1,569,950.
   (*b*) Annual medical and sanitary expenditure.—£76,250.
   (*c*) Upkeep of Government hospitals and dispensaries—.
   (*d*) Total salaries and allowances of medical officers.—£41,217.
   (*e*) Total annual sanitary expenditure—.
13. Towns under Municipalities or Town Councils :—
   (*a*) Number of such.—1.
   (*b*) Total population.—73,766.
   (*c*) Total revenues.—£16,954 0s. 7d.
   (*d*) Total medical and sanitary expenditure.—£21,477.

14. Table of deaths by districts.—Statistics unreliable.

15. Table of deaths in the principal towns:—

Town.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Lagos	—	73,766	178	138	170	130	123	161	205	188	163	161	144	176	1,937
Ebute Metta			26	29	28	27	33	32	29	30	24	20	24	23	325
Total		—	204	167	198	157	156	193	234	218	187	181	168	199	2,262

16. Rainfall during the year 1910.

Where observed.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
WESTERN PROVINCE.													
Lagos	·38	·08	·94	4·48	8·79	16·70	21·29	2·82	4·95	7·00	1·86	·14	69·43
Epe	·57	·95	·54	6·46	10·39	14·50	22·41	9·98	7·48	7·95	·37	·49	82·09
Badagry	—	—	1·77	3·57	6·07	11·99	17·17	·80	4·63	5·96	1·10	—	53·06
Ebute Metta	—	·10	*	3 62	6·76	18 62	22·01	3·82	8·41	6·24	*	·21	69·79†
Otta Station	—	·55	2·11	4·35	10·25	6·90	8·88	3·40	5·55	6·45	—	—	48·44
Abeokuta	—	1·28	2·99	7·71	4·62	5·21	11·03	3·45	6·35	*	—	*	42·64†
Olokemeji	—	—	3·87	6·19	6·49	9·56	5·83	6·48	6·41	7·02	·94	—	52·79
Ibadan	·23	·53	2·71	10·44	6·25	9·18	9·91	5·94	4·73	10·44	—	*	60·00†
Oyo	*	·05	1·85	8·11	6·93	3·47	*	3·90	8·00	10·52	—	—	42·83†
Ogbomoso	1·45	*	*	*	*	*	*	*	*	*	*	*	1·45†
Oshogbo	·01	·98	3·36	4·80	7·03	4·29	8·72	*	7·47	4·29	·48	—	41·43†
Ilesha	—	·09	4·00	8·90	8·26	8·63	8·47	4·88	5·35	13·85	·77	—	63·20
Ondo	*	·12	1·45	4·35	4·37	8·44	13·67	14·14	11·03	6·28	—	*	63·85†
Average Fall per Station ...	·24	·39	2·32	6·08	7·18	9·79	13·58	5·42	6·66	7·81	·50	·09	
CENTRAL PROVINCE.													
Warri	1·57	·29	2·47	8·25	8·00	24·74	9·15	19·17	19·49	9·65	4·50	·35	107·63
Forcados	·05	3·50	2·85	7·15	17·70	14·60	19·30	15·75	21·80	10·50	·80	·30	114·30
Onitsha	·43	1·82	2·065	5·34	5·26	5·54	12·09	17·67	8·87	10·34	—	·40	69·82
Sapele	—	·10	3·54	10·29	6·90	18·84	16·64	21·09	16·42	11·42	—	—	105·24
Benin	—	·89	·71	1·51	10·24	12·44	10·94	15·75	18·08	8·96	1·50	—	81·02
Aboh	·66	·53	3·35	3·42	17·30	11·84	15·90	8·98	7·99	3·96	—	—	73·93
Udi	—	·39	2·41	6·95	10·82	13·35	14·33	11·15	8·49	8·23	—	—	76·12
Okwoga	*	*	*	4·02	*	*	10·27	17·31	5·59	11·30	·50	—	48·99†
Average Fall per Station ...	·38	1·07	2·48	5·86	10·89	14·18	13·57	15·86	13·34	9·29	·91	·13	
EASTERN PROVINCE.													
Calabar	·03	1·59	·89	3·52	5·87	6·89	10·58	41·24	20·77	10·73	*	·39	102·50†
Bonny	1·50	4·00	*	9·40	7·06	29·24	17·80	19·65	16·35	13·25	11·52	2·28	132·05†
Opobo	·71	4·65	2·85	5·56	4·82	10·88	18·37	23·24	19·33	14·08	5·42	—	109·91
Degema	·85	·65	4·57	9·73	9·69	8·91	11·61	10·98	13·57	4·28	3·30	—	78·14
Brass	·91	4·51	7·84	6·01	7·64	21·88	19·94	11·61	25·19	19·32	12·52	4·91	142·28
Akassa	1·30	5·29	8·31	8·75	11·74	27·08	21·18	8·40	25·32	17·23	6·77	7·55	148·92
Afikpo	2·31	·87	6·34	2·03	2·98	6·49	4·18	11·78	6·39	7·19	—	·97	51·53
Ikot Ekpene	·90	—	1·98	7·86	7·33	15·60	10·32	22·45	7·76	9·79	2·16	·33	86·48
Ikom	*	*	2·93	4·05	8·40	14·55	14·18	15·96	8·51	4·07	·06	—	72·71†
Owerri	·68	2·91	1·56	8·89	6·27	14·50	8·26	21·85	15·07	6·02	—	*	86·01†
Oban	1·87	·57	·65	11·87	12·33	23·78	24·95	23·99	24·16	10·11	4·27	2·47	141·02
Average Fall per Station ...	1·10	2·50	3·79	7·06	7·64	16·34	14·67	19·19	16·58	10·55	4·60	1·89	

* No records available. † Records incomplete.

17. Additional information to be given if possible on the following points:—

(*a*) Is there any legislation in force against the breeding of mosquitos in premises? Numbers of notices, convictions, and warnings during the year.

(*a*) There is an Ordinance for the destruction of mosquitos which has been applied to the following places:—Lagos Colony, Calabar, Opobo, Bonny, Brass, Degema, Warri, Sapele, Forcados, Onitsha, and Abo.

Number of written notices.—383.

(It has not been the custom to issue written notices under this Ordinance.)

Number of warnings.—Innumerable.

Number of convictions.—244.

(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does Kala-azar exist?

(*b*) Large numbers have been examined all over the Colony, but accurate records have not been filed.

Place.	No. examined.	Percentage affected.
Ikom	?	50
Obubra	?	50

Kala-azar has not been reported and is not known to exist.

(*c*) Number of persons examined for filarial diseases. Where was this done? Percentage affected.

(*c*) No records have been filed.

	No. of examinations.	Percentage affected.
Ikom Prison	?	1·25

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost.

(*d*) Lagos:—

Drainage, £800.
Drainage, £2,000 (part of a regularly laid-out scheme which will cost not less than £150,000).
Reclamation, Public Works Department, £1,805.
Reclamation by dredger, £1,959.
Calabar drainage, £1,000.
Calabar reclamation, £600.
Opobo reclamation, £350.
Bonny reclamation, £369.
Total drainage, £3,800.
Total reclamation, £5,083.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.

		No. of men employed.	Cost. £
(*e*)	Lagos	97	740
	Calabar	13	300
	Bonny	15	155
	Degema	7	108

(*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed.

(*f*) Amount of quinine, 2,749,923 grains.

The main agencies in its distribution are the Government dispensaries and, in a few instances, missions and schools.

(*g*) Is quinine distributed regularly in the schools?

(*g*) In a few places quinine is distributed in schools, but how regularly I am unable to say.

(*h*) Measures taken against these diseases on estates employing indentured labour.

(*h*) No estates employing indentured labour.

(*i*) Any steps taken regarding the housing of the poor.

(*i*) None.

(*j*) Any exceptional increase or decrease of these diseases recently noticed.

(*j*) None.

ARTHUR PICKELS.

No. 13.

UGANDA.

(Received 1 September, 1911.)

The Prevention of Mosquito-borne Diseases.

Return called for in Secretary of State's circulars, dated 20th December, 1910, and 6th January, 1911.

1. *Name of Colony:*
   Uganda Protectorate.
2. *Total Area:*
   73,319 square miles.
3. *Estimated Population:*
   Europeans, 560.
   Other races, 2,616,000.
4. *Births:*
   29,611, approximately.
5. *Deaths:*
   Attributed to fever : 3,756, approximately.
   ,, blackwater fever : not known.
   ,, yellow fever : none.
   Total deaths : 31,633.
6. *Government Hospitals:*
   (*a*) Number : 12.
   (*b*) Admissions :

Admissions	Europeans	66
	Natives	2,174
	Total	2,240

   (*c*) Malarial fevers, admissions : Natives, 440; Europeans, 29
   ,, ,, deaths : Natives, 7; Europeans, —
   (*d*) Blackwater fever, admissions : natives, 9.
   ,, ,, deaths, nil.
   (*e*) Yellow fever : admissions, nil.
   ,, ,, deaths, nil.
   (*f*) Filarial diseases : admissions / ,, ,, deaths } not available.
   Elephantiasis is uncommon.
   (*g*) Dengue, admissions : natives, 2.
   ,, deaths, nil.
7. *Government Dispensaries:*
   (*a*) Number of dispensaries, 12.
   (*b*) Total attendances during the year, 64,124.
   (*c*) Attendances for malaria, 3,504.
   (*d*) ,, ,, filarial diseases, not available.
   (*e*) ,, ,, dengue, 113.
8. *Medical Service:*
   (*a*) Number of Government Medical Officers, 19.
   (*b*) ,, ,, Special Health Officers, nil.
   (*c*) ,, ,, other registered practitioners, 3.
9. *Schools:* No information beyond Blue Book returns.
10. *Estates, &c.:* Not known in Medical Department.
11. *Estimated Revenue of Colony:* Not known in Medical Department.
12. *Estimated Expenditure of Colony:* Not known in Medical Department.
13. *Towns under Municipalities or Town Councils:* None.
14. *Table of deaths by Districts:* (Attached).
15. *Table of deaths in principal towns:* (Not available).
16. *Rainfall during the year:* Not known in Medical Department.

17. (*a*) *Is there any legislation in force against the breeding of mosquitoes in premises?* None in force during 1910, but rules have been drawn up recently under the Townships Ordinance to prevent the breeding of mosquitoes in compounds, &c.

Numbers of notices, convictions, and warnings during the year. None during 1910.

(*b*) *Number of children examined for enlarged spleens.*—No record.
Where was this done? —
Percentage affected? —
Does Kala Azar exist? No known cases.

(*c*) *Number of persons examined for filarial diseases:* No record.
Where was this done? —
Percentage affected? —

(*d*) *Any large works for surface drainage of towns or reclamation of marshes?* Drainage of swamp at Kampala. Approximate cost, £312.

(*e*) *Number of men employed in towns and villages for petty anti-mosquito works:* Not known in Medical Department. Approximate cost not known in Medical Department.

(*f*) *Amount of Government quinine sold or distributed gratis during the year:* 5 gr. tabloids, No. 33,400; Quin. Pulv., 101 lbs. 10 ozs.; Quin. Capsules, No. 613. Agencies employed: Government dispensaries.

(*g*) *Is quinine distributed regularly in the Schools?* Not known in Medical Department.

(*h*) *Measures taken against these diseases, &c.:* Clearing of grass and undergrowth in townships and compounds. Wire gauze doors and windows to houses. Use of mosquito nets. Taking of quinine, &c., by officials. No measures in native shambas.

(*i*) *Housing of the poor:* —

(*j*) *Any exceptional increase or decrease of these diseases recently noticed?* None.

(*k*) *Any other remarks on the subject?* For further information please see Annual Medical Report for 1910.

A. D. P. HODGES,
Principal Medical Officer,
Uganda Protectorate.

Table of Deaths by Districts.

Total Deaths.

District.	Area in Square Miles.	Population.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Buganda	16,393	670,000	969	1,067	875	1,092	1,070	1,235	1,262	1,118	1,149	1,028	1,035	957	12,857
Eastern Province	13,800	1,026,000	568	482	506	602	480	484	629	594	504	667	535	582	6,633
Bunyoro	4,900	170,000	326	260	235	338	281	236	234	177	155	192	204	103	2,741
Toro ...	6,000	100,000	180	200	220	282	221	313	354	2,887	286	404	429	248	6,024
Ankole ...	4,800	250,000	405	359	319	402	295	269	190	234	189	236	211	269	3,378
Unadministered Areas.	27,426	400,000						No re	turns.						
Totals ...	73,319	2,616,000	2,448	2,368	2,155	2,716	2,347	2,537	2,669	5,010	2,283	2,527	2,414	2,159	31,633

These returns are of recent institution, are made by native chiefs, and must be regarded as merely approximate.

No. 14.

BAHAMAS.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received 21 March, 1911.)

SIR, Government House, Nassau, March 3rd, 1911.

I HAVE the honour to acknowledge receipt of your Circular Despatch of December 20th, 1910,* and to forward herewith, for transmission to Professor Ronald Ross, a copy of a report prepared by the Acting Medical Inspector and the Resident Surgeon of the Bahamas General Hospital on the prevention of mosquito-borne disease in this Colony.

2. With regard to the annexure to the return suggested by the professor, considerable time and labour will be saved if printed forms are supplied by the University of Liverpool for future use.

I have, &c.,
W. GREY WILSON,
Governor.

Enclosure in No. 14.

SIR, Nassau, New Providence, Bahamas, January 31st, 1911.

IN response to your request to draw up a report on "The Prevention of Mosquito-borne Diseases" in this Colony, we have now the honour to forward a report based on the statistics in the Blue Book 1909-1910, together with such other data at our disposal.

The Bahamas are geographically sub-tropical, and but few of the "tropical diseases" exist here endemically. Of those which are mosquito-borne, malarial fevers—mostly of a benign type—are the only ones of any real importance; as, however, the main varieties of culicidæ are present in most settlements, the importation of any of these diseases might be followed by an epidemic.

At all the chief ports routine visitation of all ships from foreign ports, is carried out by a quarantine officer, who refers all cases of a suspicious nature to the Health Officer. At Nassau, where most of the traffic with foreign parts occurs, a well isolated and mosquito-proof hospital is provided for the reception of suspected cases.

The greater number of the widely scattered and sparsely populated settlements of the Colony are without the services of a medical man, and the collection of health statistics is therefore a matter of considerable difficulty and is of doubtful value.

We have, &c.,
J. BAIRD ALBURY, M.R.C.S.
J. J. CULMER, M.R.C.S., &c.

The Honourable Colonial Secretary.

Annexure.

1. Name of Colony.—The Bahamas.
2. Total area.—4,403½ square miles.
3. Estimated population.—
   (*a*) Total—53,735.
   (*b*) Europeans—About one-third.
   (*c*) Negroes—About two-thirds.
   (*d*) Other races—
   (*e*)
4. Births during the year—2,167.
5. Deaths during the year.—
   (*a*) Total—1,173.
   (*b*) Ascribed to fever—Not known.
   (*c*) Ascribed to blackwater fever—None.
   (*d*) Ascribed to yellow fever—None.

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* No. 11 in Appendix I in [Cd. 5514].

6. Government Hospitals.—
   (*a*) Number of such hospitals—1.
   (*b*) Totals during year—Admissions, 438; deaths, 101.
   (*c*) Malarial fever—Admissions, 8; deaths, 1.
   (*d*) Blackwater fever—None.
   (*e*) Yellow fever—None.
   (*f*) Filarial diseases—None.
   (*g*) Dengue—None.
7. Government Dispensaries.—
   (*a*) Number of such dispensaries—1.
   (*b*) Total attendance during the year—2,751.
   (*c*) Attendance for malaria—106.
   (*d*) Attendance for filarial diseases—None.
   (*e*) Attendance for dengue—None.
8. Medical Service.—
   (*a*) Number of Government Medical Officers—7.
   (*b*) Number of Special Sanitary Officers—1.
   (*c*) Number of other registered practitioners—22.
9. Schools.—
   (*a*) Number of Government and State-aided schools—64.
   (*b*) Number of scholars registered—7,786.
   (*c*) Percentage of daily attendance—78 per cent.
10. Estates employing indentured labour.—None.
11. Estimated Revenue of the Colony—£82,915.
12. Estimated Expenditure of the Colony—£84,630.
   (*a*) Annual medical and sanitary expenditure—£1,393.
   (*b*) Upkeep of Government Hospitals and Dispensaries—£5,300.
   (*c*) Total salaries and allowances to medical officers—£1,116.
   (*d*) Total annual sanitary expenditure—£7,809.
13. Towns under Municipalities or Town Councils.—None.
14. Table of deaths by districts.—Not obtainable.
15. Table of deaths in principal towns.—Not obtainable.
16. Rainfall during the year.—

Where observed.	District.	January.	February.	March.	April.	May.	June.
Nassau	New Providence ...	2·21	·42	1·49	4·58	9·48	5·12

Where observed.	District.	July.	August.	September.	October.	November.	December.
Nassau	New Providence ...	3·60	7·30	5·08	3·93	·80	·47

17. Total rainfall—44·48 inches.

a. Yes. A copy is enclosed. Frequent notices and warnings have been given, but no prosecutions.

b. Children have not been systematically examined for enlarged spleens, but judging from the observations in private practice, they are not very frequent.

c. A case is seen once every few years only.

d. None.

e. None.

f. Quinine is sold at cost price by all local magistrates.

g. No.

h. No indentured labour.

i. None.

j. —

k. Mosquito-nets are in fairly general use among the white population.

J. Baird Albury, M.R.C.S., &c.
J. J. Culmer, M.R.C.S., &c.

No. 15.

BARBADOS.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received November 28, 1911.)

SIR, Government House, 13th November, 1911.

I HAVE the honour to enclose copy of a report, dated the 8th November, 1911, by Dr. Hutson, the Poor Law Inspector, which furnishes the information asked for by your circular despatch of the 20th December, 1910,* concerning the subject of the prevention of mosquito-borne diseases.

2. The statistics supplied in the report are based upon the census returns, and the report has been purposely delayed until those returns were available.

3. The non-existence of a medical department in this Colony would make it difficult to arrange for the rendition of a similar report annually, but Dr. Hutson—whose voluntary services in this and other similar matters can always be relied upon—has pointed out that the non-existence of malaria, and the fact that yellow fever and dengue, although occurring at intervals, are not endemic, would necessarily make an annual report very meagre as regards information of interest.

I have, &c.,
L. PROBYN,
Governor.

Enclosure in No. 15.

RETURN of malarial fever, blackwater fever, yellow fever, filariasis, and dengue during the year from January 1st to December 31st, 1910.

1. Name of Colony : Barbados.
2. Total area : 166 square miles.
3. Estimated population : —
   (*a*) Total, 171,983.
   (*b*) White (European descent and Europeans), 12,063.
   (*c*) Black, 118,387.
   (*d*) Mixed, 41,533.
4. Births during the year :
   Total births, 6,381. Birth-rate, 26·9.
5. Deaths during the year :
   There is no registration of deaths in the Colony and there is only a record of burials. No causes of death are registered except in the medical institutions.
   (*a*) Total deaths (burials), 4,383.
   (*b*) Deaths ascribed to fever,—no record.
   (*c*) Deaths ascribed to blackwater fever,—no record, but this disease does not occur in the Colony.
   (*d*) Deaths ascribed to yellow fever,—none. Yellow fever is notifiable and no case occurred during the year.

6. There is one Government hospital, and 11 almshouses supported by local taxation in the several parishes. These almshouses are used as district hospitals to a varying extent.

   (*a*) Total admissions : General Hospital, 3,572; Parochial Almshouses, 2,653; total, 6,225.
   (*b*) Total deaths : General Hospital, 316; Parochial Almshouses, 545; total, 861.
   (*c*) Malarial fever : admissions, 12; deaths, 1.

There is no indigenous malarial fever in the Colony, as no anophelines occur. Only imported cases are observed, and the vast majority of these are better-class

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* No. 11 in Appendix I in [Cd. 5514].

persons who do not resort to the institutions. The total number of cases is probably large, and they come from British Guiana, the neighbouring West Indian Islands, the Isthmus of Panama, and Brazil.

(*d*) Blackwater fever : admissions, none; deaths, none.
(*e*) Yellow fever : admissions, none; deaths, none.
(*f*) Filarial diseases : admissions, 21; deaths, 2.

These figures refer to the General Hospital only.

(*g*) Dengue : admissions, none; deaths, none.

7. Government dispensaries :

(*a*) There is one Government dispensary (at the General Hospital) and 11 parochial dispensaries in the several parishes.
(*b*) Total attendances : hospital, 25,039; parochial, 14,647; total, 39,686.
(*c*) Attendances for malaria.—Record not complete, probably none.
(*d*) Attendances for filarial diseases.—Record not complete. This will be given fully in future years. The number is inconsiderable, as few persons of the lower classes apply for treatment.
(*e*) Attendances for dengue.—Record not complete, probably none.

8. Medical Service :

(*a*) Number of medical officers.—There are 11 Government Medical Officers and 12 parochial medical officers, the latter being the district medical officers appointed and paid by the local authorities in each parish (the Vestries). The Government Medical Officers are attached to the port, the police, the prisons, the lunatic asylum, the leper asylum, and there is a Poor Law Inspector (medical), who also inspects the medical institutions.

There are also seven medical officers attached to the General Hospital, who are appointed by the Board of Directors. Two of these are also Government Medical Officers.

(*b*) Number of special health officers.—None, except the two Port Medical Officers, whose duties are confined to the port. There is no medical officer of health for the Colony.
(*c*) Other registered practitioners, 28. Total in the Colony, 53.

9. Schools :

(*a*) Number of Government elementary schools, 170.
(*b*) Number of scholars registered, 27,943.
(*c*) Percentage of daily attendances, 60·8 per cent.

10. Estates employing indentured labour : none.

11. Revenue of the Colony :

Total during the year, £265,728 14s. 5d. (Government, £205,725 19s. 5d.; Parochial, £60,002 15.)

Both the Government and the Local Authorities have separate systems for raising revenue and controlling expenditure.

12. Expenditure of the Colony :

(*a*) Government, £203,455 0s. 3d.; Parochial, £47,260.; total, £250,715 0s. 3d.
(*b*) Medical and sanitary expenditure: Government, £21,469 14s. 4d.; Parochial, £28,186; total, £49,655 14s. 4d.
(*c*) Upkeep of hospitals and dispensaries: General Hospital, £8,954 5s.; Almshouses, £9,479 5s. 8d.; total, £18,433 10s. 8d.
(*d*) Total salaries of medical officers: Government, £1,975; Parochial, £3,595; total, £5,570.
There are no allowances.
(*e*) Total sanitary expenditure: Government, £2,035 11s. 9d.; Parochial, £8,094; total, £10,129 11s. 9d.

13. Towns under municipalities or town councils : none.

14. Table of deaths by districts :

Parish.	Area in sq. miles.	Population.	Burials for the quarter ending the last day of*				Total.
			March.	June.	September.	December.	
St. Michael	15	57,382	369	412	544	474	1,799
Christ Church ...	22·3	20,206	77	95	132	109	413
St. George	16·9	14,329	100	85	121	124	430
St. Philip	23·5	17,023	74	124	144	101	443
St. John	13·5	10,137	41	30	47	61	179
St. James	12·1	10,615	45	49	75	89	258
St. Thomas	13·3	7,921	35	42	56	66	199
St. Peter	13	9,423	43	50	48	71	212
St. Lucy	13·6	8,951	23	40	52	59	174
St. Joseph	9·4	7,837	39	28	40	53	160
St. Andrew	13·7	8,159	29	31	22	34	116
Total	166·3	171,983	875	986	1,281	1,241	4,383

* As compiled by the Registrar.

15. No table of burials in the chief town is compiled separately. The burials are included in the parish of St. Michael, where Bridgetown is situated.

16. Rainfall during the year :

Average of 163 districts throughout the Island. Rainfall in inches.

January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
2·27	1·93	2·38	2·69	13·44	5·79	6·88	6·52	6·59	7·68	3·15	2·78	60·34

17.—(*a*) Under the Public Health Act there are mosquito rules forbidding the keeping of "stagnant water" about the premises of householders, and the presence of mosquito larvæ is made the test of stagnant water. A penalty in the form of a fine, not exceeding twenty shillings, is attached.

In 1909 during a small epidemic of yellow fever there were numerous prosecutions in each district, but in 1910 there were few, as householders were made to realise the gravity of the offence. Accurate figures of notices, convictions, and warnings will be included in future reports.

(*b*) No examination of children for enlarged spleens is made, as no endemic malaria exists. Kala-azar does not exist.

(*c*) No systematic examination of persons for filarial diseases is made. These diseases are treated as they occur, if treatment is desired. Dr. G. C. Low in 1901 estimated the prevalence of these diseases in the institution population at about 10 per cent. as the result of about 800 examinations.

(*d*) No large drainage works for surface drainage of towns or reclamation of marshes have been undertaken in recent years.

(*e*) Thirty-eight sanitary inspectors are engaged in enforcing the mosquito rules throughout the island in addition to their other duties, and every house in the island is supposed to be inspected for this purpose at least once a month. There is a pipe-borne water supply throughout the whole island, except in a small area in the highland district, and the Government are at present extending this system so as to supply the highlands completely.

Water barrels are found to be the chief source of mosquitos, and since mosquito inspection was begun two years ago these barrels have been discouraged and householders have generally abandoned them for their own protection.

(*f*) No quinine is distributed or sold.

(*g*) There is no endemic malaria.

(*h*) No indentured labour is employed.

(*i*) There are no measures taken for housing the poor. In-door relief is given under the Poor Relief Act to all persons who are homeless.

(*j*) No exceptional increase or decrease of these diseases has been noticed recently. There has been for some years apparently a steady increase in the

incidence of filarial diseases, but there are no statistics available to prove this expression of opinion.

JOHN HUTSON, M.B., D.P.H.,
Poor Law Inspector.

8th November, 1911.

No. 16.

BRITISH GUIANA.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE, DURING THE YEAR FROM THE 1ST JANUARY TO THE 31ST DECEMBER, 1910.

(Received 3 October, 1911.)

1. Name of Colony, British Guiana.
2. Total area (estimated), 90,200 square miles.
3. Estimated population,* 303,197.†
   (a) European other than Portuguese, 4,113.
   (b) Portuguese, 10,827.
   (c) East Indians, 126,148.
   (d) Chinese, 2,188.
   (e) Aborigines, 6,955.
   (f) Africans, 1,134.
   (g) Blacks, 115,932.
   (h) Mixed races, 35,908.
4. Births during the year:—
   Total births, 8,332.
5. Deaths during the year:—
   (a) Total deaths, 10,424.
   (b) Deaths ascribed to fever, 2,124.
   (c) Deaths ascribed to blackwater fever, 9.
   (d) Deaths ascribed to yellow fever, nil.
6. Government hospitals:—
   (a) Number of such hospitals, 5.
   (b) Totals during year:—

Admissions	16,068
Deaths	2,069

   (c) Malarial fever:—

Admissions	2,077
Deaths	98

   (d) Blackwater fever:—

Admissions	2
Deaths	1

   (e) Yellow fever:—

Admissions	Nil.
Deaths	Nil.

   (f) Filarial Diseases:—

Admissions	239
Deaths	17

   (g) Dengue:—

Admissions	Nil.
Deaths	Nil.

7. Government dispensaries:—
   (a) Number of such dispensaries, 10.
   (b) Total attendances during year, 26,260.
   (c) Attendances for Malaria, 2,784.
   (d) Attendances for filarial diseases, 495.
   (e) Attendances for dengue, nil.
8. Medical service:—
   (a) Number of (i) Government medical officers, 41.
   (ii) Medical practitioners subsidised to dispensaries, 3.

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* N.B.—By census, 1891, 278,328.

† The races as regards 8 cases of deaths were not ascertained when figures were being worked out at 31st December, 1909.

(*b*) Number of special health officers, 1.
(*c*) Number of other registered practitioners, 15.

9. Schools:—
(*a*) Number of Government and State-aided schools, 227.*
(*b*) Number of scholars registered in these schools, 34,562.
(*c*) Percentage of daily attendances (21,555), 62 per cent.

10. Estates employing indentured labour:—
(*a*) Number of such, 39.
(*b*) Number of indentured labourers employed, 62,477.
(*c*) Number of hospitals and dispensaries on such estates, 39.
(*d*) Total deaths among such labourers, 1,463.
(*e*) Deaths ascribed to Malaria, 199.
(*f*) Total admissions to hospitals, 55,660.
Total attendances at dispensaries, 11,774.
(*g*) Total admissions to hospitals for malarial fever, 22,312.

11. Revenue of Colony:—
Total during year 1910-1911, £563,100.

12. Expenditure of Colony:—
(*a*) Total during year 1910-1911, £542,757.
(*b*) Annual medical and sanitary expenditure, £75,551 9s. 4d.†
(*c*) Upkeep of Government hospitals and dispensaries, £38,755 19s.
(*d*) Total salaries and allowances of medical officers, £26,481 4s. 4d.
(*e*) Total annual sanitary expenditure (same as under (*b*)).

13. Towns under municipalities or town councils:—
(*a*) Number of such, 2.
(*b*) Total population, 66,197.
(*c*) Total revenues during year 1910, £66,643 7s.
(*d*) Total medical and sanitary expenditure during year 1910, £13,499 13s. 2½d.‡

14. Table of Deaths by Districts:—

District.	Area.	§Population.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Berbice.	17,900 square miles.														
Corentine and East Coast		14,484	41	59	55	37	43	36	35	57	71	48	51	60	593
Canje		8,653	25	13	24	18	16	18	19	20	19	21	16	17	226
New Amsterdam		8,903	57	49	65	55	47	42	52	46	41	63	43	41	601
Berbice River		12,814	28	32	34	24	34	22	29	27	43	31	34	45	383
West Coast		6,322	36	25	24	11	20	19	21	20	36	26	34	25	297
Demerara.	4,800 square miles.														
Mahaica-Mahaicony ...		9,584	41	47	33	31	28	23	32	34	46	41	45	63	464
East Coast		47,431	130	133	115	91	83	119	83	116	98	94	128	157	1,347
Georgetown and environs		53,176	321	284	267	222	230	217	230	253	225	256	241	282	3,028
East Bank		14,282	38	49	59	37	38	31	29	32	27	23	30	29	422
Demerara River		7,208	21	31	22	16	21	24	24	16	24	25	36	24	284
West Bank		16,057	46	36	53	24	48	42	26	38	35	33	35	51	467
West Coast		26,160	74	67	73	49	50	51	53	39	54	45	53	85	693
Essequibo.	67,500 square miles.														
Essequibo River		10,188	9	13	29	22	22	11	20	13	23	11	20	19	212
Wakenaam and Leguan ...		12,633	16	24	32	22	21	28	16	22	14	32	20	22	269
Essequibo Coast		25,517	92	74	79	87	76	65	66	75	65	69	76	85	909
Pomeroon and North-West District.		4,916	15	19	22	14	19	16	15	21	22	18	29	19	229
Total	90,200 square miles.	278,328	990	955	986	760	796	764	750	829	843	836	891	1,024	10,424

* Includes Orphan Asylum, Onderneeming, and H.M.P.S. Schools.
† Includes £38,755 19*s.* 0*d.* given under (*c*).
Includes £26,481 4*s.* 4*d.* given under (*d*).
‡ Does not include Government expenditure which is included under 12 (*b*), (*c*), and (*d*) above.
§ By census, 1891.

15. Table of Deaths in the Principal Towns:—

(*a*) Deaths in Georgetown.

Town.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
GEORGETOWN.															
Ward.															
1. Kingston	At the mouth and on the eastern bank of the River Demerara.	53,176*.	9	7	6	3	4	5	6	3	1	3	4	5	56
2. North Cumingsburg, W. ½.			1	3	3	3	—	2	—	1	—	1	—	1	15
3. North Cumingsburg, E. ½.			4	10	6	1	—	4	1	4	7	8	1	5	51
4. South Cumingsburg, W. ½.			2	5	3	4	2	6	1	3	3	1	3	4	37
5. South Cumingsburg, E. ½.			8	11	4	10	2	6	8	2	3	9	3	4	70
6. Robb's Town			—	—	1	—	—	1	—	—	1	—	—	—	3
7. Lacy Town			9	9	10	7	11	11	5	10	9	7	7	7	102
8. New Town			1	—	—	—	—	—	—	—	—	1	—	—	2
9. Stabroek			5	4	3	4	2	1	2	4	2	—	3	2	32
10. Werken Rust			27	23	22	14	19	21	15	18	18	11	14	19	221
11. Charlestown			17	8	11	15	9	11	12	11	11	8	12	13	138
12. Bourda			12	9	18	11	8	9	10	7	5	8	5	9	111
13. Albert Town			4	13	9	9	6	9	4	6	4	6	8	6	84
14. Queenstown			4	5	5	1	4	2	1	3	—	2	2	3	32
Environs.															
The Lodge			4	3	5	—	1	3	1	2	1	2	2	2	26
Albuoystown			10	8	8	6	6	7	11	7	5	6	6	10	90
Hospital.															
Town Patients			57	50	44	46	38	38	49	49	53	57	62	58	601
Country Patients ...			86	64	76	60	61	40	75	78	51	62	64	81	798
Almshouse			61	52	33	28	56	42	29	45	51	65	44	53	559
Orphan Asylum			—	—	—	—	—	—	—	—	—	—	—	—	—
Jail			—	—	—	—	—	—	—	—	—	—	—	—	—
Shipping, &c.			—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	53,176	321	284	267	222	229	218	230	253	225	257	240	282	3,028

(*b*) New Amsterdam and Environs.

Town.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
NEW AMSTERDAM.															
Smyth Town	On eastern bank and 5 miles from the mouth of the River Berbice.	8,903.*	7	10	14	12	10	7	7	6	6	7	7	5	98
Queenstown			—	—	—	—	—	—	—	—	—	—	—	—	—
Stanleytown			2	4	—	—	1	1	1	4	1	4	—	—	18
Hospital															
Town Patients			9	8	17	11	5	11	9	6	6	12	8	10	112
Country Patients ...			32	24	24	28	28	21	31	25	17	35	25	21	311
Lunatic Asylum			7	3	9	3	3	1	4	5	10	5	3	5	58
Jail			—	—	—	—	—	—	—	—	—	—	—	—	—
Shipping, &c.			—	—	1	—	—	1	—	—	1	—	—	—	3
Environs.															
Winkel Village			—	—	—	1	—	—	—	—	—	—	—	—	1
Total	—	8,903	57	49	65	55	47	42	52	46	41	63	43	41	601

* Census, 1891.

16. Rainfall during the year:—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Botanic Gardens.	George-town, Demerara.	Inches. 8·09	Inches. 7·95	Inches. 10·00	Inches. 7·86	Inches. 10·81	Inches. 14·74	Inches. 11·17	Inches. 14·76	Inches. 6·60	Inches. 2·72	Inches. 3·76	Inches. 3·00	Inches. 101·46

17.—(*a*) Yes; the Mosquito Ordinance, No. 19, of 1910, and the by-laws relating to the screening of vats, 1907.

The Mosquito Ordinance only recently came into force and applies to the whole Colony. The people are being warned, but up to the present there has only been one prosecution.

The by-laws only apply to the City of Georgetown, and are administered by the Town Council. I know many warnings have been given and several prosecutions have taken place.

(*b*) The children of East Indian immigrants resident on several sugar estates have been regularly examined. Instructions have been issued for returns to be sent in every six months.

Kala-Azar does not exist.

(*c*) There is no systematic examination of persons for filarial diseases.

(*d*) In the City of Georgetown the ordinary mud drains are being gradually replaced by concrete or stone. The expenditure is under the control of the Town Council.

(*e*) A mosquito survey is being made of the City of Georgetown. I am not aware of the number employed in petty anti-mosquito works.

(*f*) 12,521 ounces sold to sugar estates and post offices. Quinine is distributed gratis on the large majority of the sugar estates; also in jails, hospitals, police force.

(*g*) No.

(*h*) *Malaria.*—(i) Systematic distribution of quinine.
(ii) Screening of water receptacles.
(iii) Keeping yards free of mosquito breeding-places.
(iv) Keeping drains clean and stocked with fish.

(*i*) There is a large almshouse in Georgetown with accommodation for 737 persons (males 545, females 192).

(*j*) There has been a considerable decrease in malarial fever, especially on the sugar estates.

(*k*) There is a very active campaign against anchylostomiasis, particularly on the sugar estates. A few years ago there were no latrines, the open fields were used. Now every sugar estate is supplied with latrine accommodation—males and females being kept separate.

Quinine is also systematically given gratis to the officers and inmates of the jails and to the police and their families.

No. 17.

BRITISH HONDURAS.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM 1ST JANUARY TO DECEMBER 31ST, 1910.

(Received 27 April, 1911.)

1. Name of Colony:—British Honduras.
2. Total area:—7,562 square miles.

3. Estimated population :—

(*a*) Total : 45,054.
(*b*) Europeans : About 400.
(*c*) Other races : The rest.

4. Births during the year :—Total births : 1,665.

5. Deaths during the year :—

(*a*) Total deaths : 1,052.
(*b*) Deaths ascribed to fever : 226.
(*c*) Deaths ascribed to blackwater fever : Nil.
(*d*) Deaths ascribed to yellow fever : Nil.

6. Government Hospitals :—

(*a*) Number of such hospitals : Three. Two new ones about to be opened.
(*b*) Totals during year : Admissions, 912; deaths, 116.
(*c*) Malarial fever : Admissions, 116; deaths, 4.
(*d*) Blackwater fever : Admissions, nil; deaths, nil.
(*e*) Yellow fever : Admissions, nil; deaths, nil.
(*f*) Filarial diseases : Admissions, nil; deaths, nil.
(*g*) Dengue : Admissions, nil; deaths, nil.

7. Government Dispensaries :—

(*a*) Number of such dispensaries : Three. These hospitals are the only medical establishments. At the end of this year we hope to have one in each district, with the exception of Cayo.
(*b*) Total attendances during the year : Not known.
(*c*) Attendances for malaria : Not known.
(*d*) Attendances for filarial diseases : Not known.
(*e*) Attendances for dengue : Not known.

8. Medical Service :—

(*a*) Number of Government Medical Officers : 7
(*b*) Number of Special Health Officers—such medical officers are Health Officers : None special.
(*c*) Number of other registered practitioners : 6.

9. Schools :—

(*a*) Number of Government-aided schools : 44.
(*b*) Number of scholars registered in these schools : 4,641.
(*c*) Average daily attendance : 3,173.

10. Estates employing indentured labour :—

(*a*) Number of such : Nil.
(*b*) Number of indentured labourers employed : Not known.
(*c*) Number of hospitals and dispensaries on such estates : Nil.
(*d*) Total deaths among such labourers : Not known.
(*e*) Deaths ascribed to malaria : Not known.
(*f*) Total admissions and attendances at hospitals and dispensaries : Nil.

11. Estimated revenue of Colony :—Total during year : $498,895.

12. Estimated expenditure of Colony :—

(*a*) Total during year : $655,716.
(*b*) Annual medical and sanitary expenditure : $38,064.
(*c*) Upkeep of Government Hospitals and Dispensaries : $38,064.
(*d*) Total salaries and allowances of medical officers : $12,135.
(*e*) Total annual sanitary expenditure : $6,292, with $1,700 Central Board of Health and Quarantine.

13. Towns under Municipalities or Town Councils :—

(*a*) Number of such : 5. District Boards.
(*b*) Total population : 28,321.
(*c*) Total revenues : $39,878.

14. Table of deaths by districts :—

Districts.	Population.	Total Deaths.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Belize ...	16,739	26	28	38	38	35	23	28	19	20	35	27	36	353
Corosal ...	6,401	14	7	12	1	14	12	10	17	11	23	15	4	140
Orange Walk	8,658	7	18	14	14	7	18	8	10	18	11	11	21	157
Stann Creek	4,443	13	7	15	16	17	27	10	10	10	4	19	10	158
Toledo ...	5,764	14	13	8	12	12	13	16	8	8	17	16	19	156
Cayo ...	3,049	5	9	7	5	15	9	3	15	4	5	4	7	88
		79	82	94	86	100	102	75	79	71	95	92	97	1,052

15.—(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Yes. Ordinance No. 1 of 1906. Number of notices, convictions, warnings during the year: 1,648 notices were issued.

(*b*) Number of children examined for enlarged spleen: Not known. Where was this done? Belize. Percentage affected: Nil.

(*c*) Number of persons examined for filarial diseases: Not known. Where was this done? Belize Hospital. Percentage affected: Nil.

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Part of Newtown Barracks filled, and it is expected that the back part of the town will also be taken in hand.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works: Nil. Approximate cost: Nil.

(*f*) Amount of Government quinine sold or distributed gratis during year: Nil. Agencies employed: Nil.

(*g*) Is quinine distributed regularly in the schools? No.

(*h*) Measures taken against these diseases on estates employing indentured labour. There are no estates employing indentured labour.

(*i*) Any steps taken in the housing of the poor? No.

(*j*) Any exceptional increase or decrease of these diseases recently noticed? Returns of causes of deaths not reliable.

(*k*) Other remarks:—Every effort is being put forward in regard to anti-malarial measures as there is improvement, and these measures are in keeping with the funds available.

3 April, 1911.

No. 18.

JAMAICA.

THE ACTING GOVERNOR to THE SECRETARY OF STATE.

(Received December 16, 1911.)

SIR, King's House, Jamaica, 22 November, 1911.

I HAVE the honour to transmit to you copies of letters from the Superintending Medical Officer and four District Medical Officers in this Colony, containing their observations on the Report* of the Advisory Committee for the Tropical Diseases Research Fund for the year 1910.

2. I also have the honour to transmit a copy of a letter from the Commissioner of the Cayman Islands on the subject.

I have, &c.,
P. C. CORK,
Acting Governor.

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* [Cd. 5514], February, 1911.

Enclosure 1 in No. 18.

The Superintending Medical Officer to the Colonial Secretary.

Sir, Island Medical Office, Kingston, 4th November, 1911.

With reference to your letters, dated 27th May, 1911, and 17th October, 1911, I have, in accordance with instructions, passed the two reports of the Advisory Committee for the Tropical Diseases Research Fund round to some of the medical officers of the Department, some of whom have made remarks which I have the honour to forward. Some have made no remarks.

The report is very interesting and gives extensive and valuable information as to what is being done in other Colonies; and what one Colony can do every Colony can do, provided always that the necessary funds are available.

With regard to malaria I may say that during the past year a large amount of quinine has been either given out free or sold.

1. Quinine is sold to the estates on which indentured coolies are employed, where it is said to be given to the coolies in 5-grain doses.

During last year 133 lbs. of quinine by weight were sold to the estates for distribution.

2. Quinine is given to the Post Office to sell in packets of 5 grains, a 5-grain tablet being wrapped up in paper and put into a small envelope on which is printed the following :—

Medical Department, Jamaica.
Quinine (grains v.).
One dose for an adult.

The 5-grain dose is sold for a farthing.

Up to the end of the financial year 1910-11, the value of the quinine sold to the Post Offices for distribution was £143 8s. 1d., which represented 167,075 farthing packets. 20 per cent. on the sales is allowed each postmistress in order to encourage her to sell the drug.

3. Quinine is sold to the Malaria Commission, most of which has been distributed free among the school children of the various schools located in malarious districts; the amount sold in this way has totalled 141 pounds 4 ounces by weight. I have heard of no serious objection on the part of any parents to their children being given free quinine.

4. The drug was also given the Police Department to sell, and 4,350 farthing packets were thus given.

5. A very small amount was also given to the Agricultural Instructors to sell—560 farthing packets being thus sold.

During the present year packets containing one grain, two grains, and three grains are also being given out to suit children of different ages.

Dr. Langley's letter on page 12 of the report seems to me to hit the mark in speaking of mosquito reduction. Some two years ago a new Health Law was passed, Law 35 of 1910, in which special provisions were drawn up to enable the mosquito question to be properly tackled, and ample powers were given the Parochial Boards to effect this work.

However, until there are appointed special officers of health whose duty it is to confine themselves to health work only I cannot believe that the results from this Law will be what they ought to be; for I do not think that the local District Medical Officers generally either have the time to carry out health work properly or that they have that freedom of action which a practitioner has who is neither engaged in private practice nor who is in any way subject to local influence.

A pamphlet on the uses of quinine has been issued, but I am firmly convinced that the teaching of sanitation should begin in the schools, where it should be taught just as in the Bible, or " one's duty to one's neighbour."

The question of mosquito extermination is not an easy one altogether in Jamaica. By law one can compel a person to prevent the breeding of mosquitoes in his back yard or tank.

By dredgers and sandpumps one may drain the mouths of rivers and full-up swamps.

There remain two things which will always cause some anxiety, however, and these are :—

(1) The trenches dug with a view to draining banana plantations;
(2) Irrigated land and irrigation canals.

In some cases in Jamaica the banana plantation and irrigated land are close alongside villages and towns. It becomes a question as to whether it would not be better to specially prohibit the growing of bananas within a certain area round towns and villages.

Regarding anchylostomiasis I may say that much more attention is being paid to it than previously. By the addition of a first-class bacteriologist to the Medical Department facilities have been provided for the various hardworked Government and private practitioners in the matter of microscopical work that did not exist a year ago.

Many specimens of fæces are being now sent up for examination by practitioners who really have no time for such work.

Among the coolies in Port Antonio Hospital and among the creoles in the Penitentiary and Spanish Town Prison the presence of anchylostoma is very noticeable, showing that it is a much more generally common parasite that it had previously been believed to be.

The medical officer attached to the Spanish Town Prison has recently found the parasite in 57 cases out of 78 persons examined.

I have received, however, no reports on "Anchylostomiasis Fever."

I can only congratulate the Medical Department on its good fortune in having at last obtained a first-class bacteriologist—one keenly interested in his work.

The opportunity is now given of having proper bacteriological investigations made with diseases that were treated in the past more by rule of thumb, and I have no doubt that many cases of what would in an ordinary way be called malaria will, in the future, probably turn out to be caused by coli or other intestinal infection.

Typhoid carriers have been discovered and an outbreak, likely to have become serious, checked by their removal and isolation.

Other diseases may now be investigated on proper lines.

I hope that having obtained a bacteriologist the Island will be fortunate enough before long to obtain an entomologist, for it seems to me that tropical diseases cannot be properly investigated unless medicine and entomology go hand in hand.

I have, &c.,
J. E. Ker,
Superintending Medical Officer.

The Honourable
the Colonial Secretary,
Kingston.

Sir, Stony Hill, 24th June, 1911.

I have the honour to acknowledge, with thanks, the receipt of a copy of the report of the Advisory Committee for the Tropical Diseases Research Fund for 1910.

With regard to paragraph 2 of the Secretary of State's despatch referred to in the Colonial Secretary's letter of 27th May, 1911, I beg to offer the following observations :—

The publication of the researches contained in the appendix shows conclusively (if proof were needed) the great value of a regular record by a central authority of work done in scattered regions by individuals, and still more by institutions.

Possibly the greatest value is that exact information is given of facts and, above all, of references to the literature of the subjects dealt with—a most important matter for the isolated worker, who is thereby able to check his results and to save much time by avoiding pitfalls into which earlier observers may have fallen.

As in general, so in particular. I would note that the value of the earliest dissemination of new and proved observations on such matters as malaria, blackwater fever, and ankylostomiasis, to name only three diseases, can hardly be overestimated. Blackwater fever is rare in this Colony, but it does occur; and it seems

to me possible that a comparison of the etiological conditions at the time of its occurrence in a place such as this with those in a district where it is commoner may throw light on what is certainly a very obscure disease, at any rate as regards its etiology.

Again, in the matter of diseases peculiar to localities, a central record such as this of analogous cases in other countries may throw sidelights showing the main points in the etiology of the disease as distinguished from the secondary matters.

The corollary of these observations amounts to this: the report shows the necessity of a general linking up of scattered observations and practice in a centre in each Colony, which centre should be in touch with the Advisory Committee. This would prevent waste of time and overlapping generally, and would be a source of exact information as to details for such Colony, especially as to literature. The extremely valuable information scattered about in reports to Governments and societies (especially as to matters of technique) is often lost to the isolated observer. Most other observations that occur to me are so obvious that I refrain from lengthening this communication, and practically everything to be said comes back to the necessity for thorough organisation and collection of exact knowledge.

I have, &c.,
R. S. Turton,
District Medical Officer.

Sir, Port Antonio, 14th August, 1911.

Having reference to the report of the Advisory Committee for the Tropical Diseases Research Fund, forwarded to me for any remarks I might like to make on it, on the 28th June last, I beg to submit the following.

At page 12 Dr. Langley's remarks on the prophylaxis of malaria should be carefully noted, in view of the feverish desire to screen and administer quinine.

Dr. Langley says: "Having in view recent experience on the Gold Coast, more thorough measures directed towards general mosquito extermination should take the first place in prophylaxis."

A considerable sum is now being expended in the screening of the Port Antonio Police Station. I question the utility of it, as it is doubtful whether the constables who contract malarial fever get the infection in the barracks; it is more likely they get it while on duty in the streets at night, and unless the screening is carried out effectually, gauze vestibules built, and careful attention paid to the closing of the doors, it is to my mind of no use; and that it most seriously interferes with ventilation there can be no question.

The gauzes that have been tried at the hospital have proved a failure, as none so far have been found that will resist the corroding influences of the weather, and the smallest hole in any one screen destroys the utility of the whole scheme.

When the matter of screening is up for discussion one is always referred to the experiment in the Roman Campagna, where several highly trained observers lived in a screened hut through a fever season without the slightest discomfort while the people around them were suffering severely from malaria. It must be borne in mind that the persons living in the hut were deeply interested in the carrying out of their experiment and every precaution was taken to exclude mosquitoes; the conditions as found in everyday life are entirely different. How often will the doors of the police station be left open, how about the constables who are on duty in the guard room? I do not suppose it is contemplated to screen that room; it would be awkward in the event of having a refractory prisoner.

That screening is an excellent thing under certain conditions there can be no doubt, but the money would be much better spent in getting rid of the mosquito.

As regards the administration of quinine, I am not as enthusiastic over this method of dealing with the prophylaxis of malaria as I was a year or more ago. I find in the case of coolies who have been having quinine regularly that at first the amount of fever was decidedly less, but that when a quininized coolie did contract an attack of malaria his attack lasted longer and was more severe in character. And, further, I did not find when quinine was administered regularly that there was any diminution in the number of enlarged spleens.

On page 76 there is an article dealing with bronchomycosis. Nearly every coolie has more or less bronchial trouble—a mild type of the condition so ably described by Dr. Castellani; now and then a severe case of the disease is seen. I have hitherto looked upon the condition as being due to irritation, the result of smoking ganja. The article in question deals with the disease as seen in Europeans; the description given, however, fits in with conditions I have frequently noticed in coolies both as regards their general symptoms and the microscopic appearances of the sputum. Reference is also made in this article to bronchospirochaetosis. A case of this sort came under observation not long ago. A creole was admitted to hospital with severe bronchial symptoms and profuse expectoration; his sputum was found to contain myriads of spirochaetes, *refingens* apparently. There was no indication of a cavity of any sort in his lung, and the condition cleared up under an expectorant mixture containing iodide of potassium.

A large number of East Indians come to hospital suffering from fever of a mild type, the temperature rarely going over 100.

On page 83 reference is made to ankylostomiasis fever; since reading the article, I have been wondering whether the cases are not identical with those described. It is impossible with the small staff at the hospital to give a subject such as this the attention it merits. A nurse looking after between 40 and 50 patients, carrying in and serving diets, looking after beds, and dressing the large number of ulcer cases that are always in hospital has no time for the collection of specimens of stools.

The coolies, too, have some extraordinary notion about allowing a specimen of the urine or stools to be taken, so that if either is required it is necessary to have the patient closely watched or otherwise the required specimen will not be obtained.

On page 105 there is a description of a method of preparing vaccine lymph that deserves attention in view of the amount of trouble that has recently been experienced in connection with the failure to obtain results. The lymph mentioned in the article is dried in vacuo over sulphuric acid; a specimen was potent after having been kept exposed to a tropical temperature for several months.

The subject of beri-beri has, I notice by the Kingston papers, been engaging the attention of the health authorities there. Ever since I have had to do with the East Indian immigrants, I have always been struck by the comparatively large number who come to hospital shortly after being located on the estates, with œdema of the feet and legs. They have never seemed specially ill, and the urine has never contained albumen. I have hitherto put the conditions down to the confinement on board ship and the consequent lack of exercise. I have always found that with a few days' rest in hospital the œdema disappeared and the coolie was discharged apparently well, to return perhaps once or twice before the trouble finally ceased.

With the last shipment, however, one case of a more severe type turned up, which on close examination presented all the symptoms of a case of moist beri-beri, anæsthesia over the tibiæ, the circulatory disturbance, &c., &c. Since then a free coolie boy has been admitted with typical symptoms of a severe moist case. In the first case the man was put on milk diet and is slowly improving; the coolie boy became dissatisfied and his parents removed him; when he left the hospital he was thoroughly waterlogged; there was, however, no albumen in his urine. There are several articles in the report dealing with rice as the causative agent; in view of this I removed rice from the dietary of both the cases referred to (this, no doubt, was the cause of the coolie boy's dissatisfaction) with certainly, in one case, excellent results.

I have, &c.,
C. A. Moseley,
District Medical Officer.

Sir, Glasgow, Adelphi P.O., September 7th, 1911.

I have the honour to acknowledge receipt of the copy of the report of the Advisory Committee for the Tropical Diseases Research Fund, and to thank you for your kind invitation to remark thereon.

The reports from other of the West Indian Islands in regard to quinine distribution are interesting and suggestive. Distribution of quinine tannate in chocolate

among children in the more highly malarial parts of Jamaica would, I feel sure, be a most valuable measure. Dr. Branch's (St. Vincent) remarks as to the primary necessity for education in regard to this method of malaria prophylaxis are entirely applicable to Jamaica.

Perusal of the rest of the report gives me hope that it will powerfully stimulate recognition of the urgent necessity for greatly extended research into the etiology and transmission of disease in Jamaica. This field is so vast that the recent establishment of the pathological laboratory in Kingston can only be regarded as a small beginning. The investigation of the biting flies and other insects (of skin, intestinal, and other parasites) of the nature of certain as yet undifferentiated fevers and other problems which I need not suggest to you, Sir, if left to the accidental inclination of individuals, will make but slow headway.

I have, &c.,

HARRY G. JOHNSTONE.

The Superintending Medical Officer.

SIR, Race Course P.O., Vere, September 18th, 1911.

I HAVE the honour to acknowledge receipt of the report of the Advisory Committee for the Tropical Diseases Research Fund for the year 1910, and beg to make a few remarks in reference to malarial treatment of diseases as applying to our own Colony.

2. Administration of quinine in tablet form to our native population has the following objections :—

(*a*) The dose is arbitrary, as Dr. Garland of the Gold Coast points out, and does not provide for dosage to infants and young children.

(*b*) The native has not been sufficiently educated to realise the difference between preventive dosage and dosage for actual disease.

(*c*) During febrile conditions the natural acids that are secreted by the stomach are absent or very slightly secreted and hence the chief aid for dissolving a compact quinine tablet no longer exists.

The tablets in many cases pass either intact through the alimentary canal or, at best, in many instances are merely broken up and very little dissolved and absorbed. I have seen too many instances where they have been passed whole.

(*d*) Coated tablets, especially gelatin, pearl, or sugar coated, should never be given under any circumstances, except to intelligent individuals who take them absolutely as a preventive measure only when in practically good health otherwise, and even then they should be advised to prick the coating in several places before swallowing.

In reference to (*a*) the arbitrary dosage—if tablets are to be distributed at all they should be in different sizes, or simple instructions plainly printed to enable the peasantry to roughly subdivide them for different ages. I have myself seen several instances of growing children being given adult doses, with bad results following, and have over and over again had natives come to me complaining that they have bought and taken adult doses with no benefit and thus wasted their money, simply because of their ignorance in not discriminating between preventive and curative measures. A few dissatisfied ones criticising (as they are so apt to do) Government measures influence many others to whom real good might have been done, and I will be very much surprised if there is not a marked diminution in the quantity of tablets sold now compared to formerly, simply because they expect too much. If tablets are taken at all and distributed broadcast simple directions should be given to take them with some acid to assist in dissolving them.

The citric acid in lime juice is easily obtained by all the natives and would obviate in a very small measure objection (*c*), and to do away with as much misunderstanding as possible it should be clearly stated that tablet dosage is of little or no good in actual fever and should only be taken as a preventive measure. In actual fever a medical man should be consulted. In that case many lives would be saved that otherwise run the risk of being lost to the State.

Quinine tablets if given at all should be the bisulphate or tannate of quinine.

These remarks I make because I do not believe in tablet dosage at all. For

many years I had been accustomed to supply mixtures of quinine in Winchester to the several estates under my charge, with simple directions as to proper dosage for adults and children, with beneficial results. This was changed when the new regulations for supplies of quinine tablets came into force. I used to prescribe a mixture containing—

Quinine Sulph.	Gr. 5
Acid Sulph. Dil.	M. 10
Ferri. Sulph.	Gr. $2\frac{1}{2}$
Mag. Sulph.	Gr. xx
Aq. ad.	℥ i

and I claim for the procedure the following advantages :—

(1) The dose is certain to be swallowed—as in many cases the tablets are kept in the mouth in the cheek until the distributing headman or book-keeper's back is turned, and spat out.

(2) The complete dissolving of the quinine by the sulphuric acid and thus ensuring quick and complete absorption.

(3) The addition of iron supplies a much needed drug in all malarial districts.

(4) The small dose of Epsom salts not only counteracts the constipating effects of the iron but assists materially the beneficial effect of the quinine by keeping up a gentle catharsis, as there always exists a more or less congested portal system.

I see Dr. McPhail (*vide* page 13, Windward Islands Report), who was one of our District Medical Officers, advocates and uses a mixture of quinine sulph., acid, and simple syrup, with, I am sure, far more advantage than tablet dosage.

On page 18 Dr. Branch describes the procedure of giving free medicine to all children under nine years of age and all labourers over 60—a most wise procedure and one that could be adopted with very material advantage by our Government and would work wonders for the physique of our future generation of labourers. I am certainly of the opinion that no less than half the deaths among our young children are preventable—not so much from their being illegitimate, as many claim, but from gross ignorance of a rudimentary knowledge of dietary and their being financially unable to obtain medical aid for their children.

In France, I believe, it is forbidden under severe penalties for anyone to give infants under one year any form of solid food unless such is ordered by a written prescription signed by a legally qualified medical man. If such an Ordinance is necessary in such a highly civilised European State how much more is it more than imperatively necessary for the benefit of our acknowledged illiterate peasantry.

If the Government would pay a nominal fee to medical men of, say, 1s. 6d. for prescribing for all children up to nine or ten years of age I am sure that it would be done, as the many attended would recoup the losses when they used to charge 4s. for a few; many now die from sheer inability of the peasantry to find the means. Far too many young lives are lost that otherwise, if saved, would be valuable assets to the State, and all for the expenditure of a few shillings per head. As soon as a child passes a year in age he becomes a consuming unit that alone, through indirect taxation, recoups the Government the small amount possibly spent on ensuring a future healthy member of the community and very quickly becoming, not only a consuming unit but a distributing or circulating, and, last but not least, a procreating unit. It means a form of State insurance that in time returns pounds for the expenditure of shillings. In support of my contention I may say that very recently in the House of Commons a discussion took place on hygiene and Dr. Addison introduced a Bill, that in elementary schools all girls of 12 years and over shall be adequately instructed in the care of feeding of infants, pointing out that no less than 120,000 under one year die from improper feeding. (There is no question of illegitimacy being a main cause as many state here.) Again, I say that if all that is necessary in England, how much more is it so here. Labourers (and indigent poor) over 60 should certainly get free outdoor treatment at the nearest hospital with no extra remuneration to the medical man, but it would be manifestly unfair to expect them to treat gratuitously all the children, for the private practices in the districts (except in the banana districts where the labourers are better off) are not half what they used to be 20 years ago, the peasantry are very much poorer, and the best of

them have left the Island, leaving their responsibilities behind them, and their children are simply dragged up, many dying. Surely it would pay the State handsomely in the end to save many of those lives, if not from a humanitarian from a utilitarian point of view.

Re the different scientific bacteriological reports, I only hope that Dr. Scott be allowed to devote his whole time to our Department as it is absolutely necessary he should do, and then we will in the future be able to make as good a showing as some of the other Colonies in research work.

I have, &c.,
HENRY TILLMAN,
District Medical Officer.

Enclosure 2 in No. 18.

The COMMISSIONER, Cayman Islands, to the COLONIAL SECRETARY.

SIR, Commissioner's Office, Grand Cayman, June 13, 1911.

I HAVE the honour to acknowledge receipt of circular from the Secretary of State dated March 15, 1911.

2. No tropical diseases occur in this Dependency, or, I should say, the only tropical diseases I have seen were cases of malarial fever imported from Central America and Jamaica. These very soon recover.

3. Two cases of yellow fever were imported from Central America 15 years ago. Both died, but no other cases occurred.

4. About 16 years ago two cases of small-pox were imported from Jamaica. Both recovered, but no other cases occurred.

I have, &c.,
GEORGE S. S. HIRST,
Commissioner.

The Honourable
the Acting Colonial Secretary,
Kingston.

No. 19.

LEEWARD ISLANDS.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received 2 May, 1911.)

SIR, Government House, Antigua, 15th April, 1911.

I HAVE the honour to forward, in duplicate, statistics for the year 1910, compiled by Dr. Duke, the Senior Medical Officer, Montserrat, in accordance with the suggestions contained in Professor Ronald Ross's note on the subject of the prevention of mosquito-borne diseases in the Tropical Colonies and Protectorates.

2. I take this opportunity of reporting that Dr. Branch, the Acting Medical Officer in the Virgin Islands, has stated that he is unable to supply the necessary statistics in regard to that Presidency, as there are no data available.

I have, &c.,
BICKHAM SWEET-ESCOTT,
Governor.

Enclosure in No. 19.

RETURN of Malarial Fever, Blackwater Fever, Yellow Fever, Filariasis, and Dengue during the year from the 1st January to the 31st December, 1910.

1. Name of Island.—Montserrat.
2. Total area.—$32\frac{1}{2}$ square miles.

3. Estimated population.—14,220.
4. Births during the year.—409.
5. Deaths during the year.—187.
   (*b*) Deaths ascribed to fever.—6.
   (*c*) Deaths ascribed to blackwater fever.—0.
   (*d*) Deaths ascribed to yellow fever.—0.
6. Government hospitals.—1.
   (*a*) Number of such hospitals.—1.
   (*b*) Totals during the year

Admissions.—46.
Deaths.—1.

(*c*) Malarial fever

Admissions.—0.
Deaths.—0.

(*d*) Blackwater fever

Admissions.—0.
Deaths.—0.

(*e*) Yellow fever

Admissions.—0.
Deaths.—0.

(*f*) Filarial diseases

Admissions.—0.
Deaths.—0.

(*g*) Dengue

Admissions.—0.
Deaths.—0.

7. Government dispensaries.—5.
   (*a*) Number of such dispensaries.—5.
   (*b*) Total attendances during year.—No record kept.
   (*c*) Attendances for malaria.—No record kept.
   (*d*) Attendances for filarial diseases.—No record kept.
   (*e*) Attendances for dengue.—No record kept.
8. Medical Service :—
   (*a*) Number of Government Medical Officers.—Two.
   (*b*) Number of special Health Officers.—One Sanitary Officer and one Medical Officer of Health.
   (*c*) Number of other registered practitioners.—None.
9. Schools :—
   (*a*) Number of Government and State-aided schools.—13.
   (*b*) Number of scholars registered in these schools.—3,153.
   (*c*) Percentage of daily attendances.—54 per cent.
10. Estates employing indentured labour :—
    (*a*) Number of such.—None.
    (*b*) Number of indentured labourers employed.—0.
    (*c*) Number of hospitals and dispensaries on such estates.—0.
    (*d*) Total deaths among the labourers.—0.
    (*e*) Deaths ascribed to malaria.—0.
    (*f*) Total admissions and attendances at hospitals and dispensaries.—0.
11. Estimated revenue of Colony (for financial year 1909-10).—£10,313.
    Total during year.—£10,612.
12. Estimated expenditure of Colony.—£7,675.
    (*a*) Total during year.—£7,806.
    (*b*) Annual medical and sanitary expenditure.—£746.
    (*c*) Upkeep of Government hospitals and dispensaries.—£466.
    (*d*) Total salaries and allowances of medical officers.—£542.
    (*e*) Total annual sanitary expenditure—£204.
13. Towns under Municipalities or Town Councils.—0.
    (*a*) Number of such.—0.
    (*b*) Total population.—0.
    (*c*) Total revenue.—0.
    (*d*) Total medical and sanitary expenditure.—0.
14. Table of deaths by Districts.

Total Deaths.

—	District.			Total.
	A.	B.	C.	
Area		Unknown.		
Population ...		?		
January	13	6	12	31
February	6	3	5	14
March	7	5	3	15
April	6	1	6	13
May	3	4	3	10
June	6	2	2	10
July	6	4	1	11
August	9	2	4	15
September	12	1	4	17
October	8	1	4	13
November	12	5	6	23
December	5	6	4	15
Total ...	93	40	54	187

N.B.—District " A."—South-western part of Island; includes town of Plymouth (population 2,000).
District " B."—Northern part of Island.
District " C."—Eastern or Windward part of Island.

15. Table of deaths in the principal towns:—
Town.—Plymouth; population, 2,000.
District where situated.—Leeward Coast.

January	4
February	1
March	3
April	2
May	0
June	2
July	3
August	6
September	8
October	4
November	6
December	1
Total	40

16. Rainfall during the year:—
Where observed.—Richmond.
District.—" A "; Leeward coast; elevation, 200 feet.

	Inches.
January	5·69
February	3·09
March	3·30
April	2·46
May	2·46
June	3·50
July	5·12
August	7·27
September	9·71
October	3·92
November	3·51
December	4·40
Total	54·43

17.—(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—No.

Number of notices, convictions, and warnings during the year.

(*b*) Number of children examined for enlarged spleen.—No records.

Where was this done?

Percentage affected.

Does Kala-azar exist?—No.

(*c*) Number of persons examined for filarial diseases.—No records.

Where was this done?

Percentage affected.

(*d*) Any large works for surface drainage of towns or reclamation of marshes?—No.

Approximate cost.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works.—0.

Approximate cost.

(*f*) Amount of Government quinine sold or distributed gratis during the year.—Unknown.

Agencies employed.—Two Government Medical Officers.

(*g*) Is quinine distributed regularly in the schools?—No.

(*h*) Measures taken against these diseases on estates employing indentured labour.

(*i*) Any steps taken regarding the housing of the poor?—No.

(*j*) Any exceptional increase or decrease of these diseases recently noticed?—No.

(*k*) Any other remarks on the subject.—Exceptionally healthy for a tropical country.

M. P. Duke,
Senior Medical Officer.

Montserrat,
31st March, 1911.

No. 20.

LEEWARD ISLANDS.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1st JANUARY TO THE 31st DECEMBER, 1910.

(Received November 14, 1911.)

Antigua.

1. Name of Colony: Antigua, Leeward Islands.
2. Total area: 108 square miles.
3. Estimated population:—
   Total, 35,667.
4. Births during the year: 1,184.
5. Deaths during the year:—
   (*a*) Total deaths, 982.
   (*b*) Deaths ascribed to fever, 30.
   (*c*) Deaths ascribed to yellow fever, none.
   (*d*) Deaths ascribed to blackwater fever, none.
6. Government hospitals:—
   (*a*) Number of such hospitals, 1.
   (*b*) Total during the year:

Admissions	790
Deaths	163

   (*c*) Malarial fever:

Admissions	23
Deaths	1

   (*d*) Blackwater fever:

(*e*) Yellow fever:
- Admissions ... ... none.
- Deaths ... ... none.

(*f*) Filarial disease:
- Admissions 13
- Deaths 6

(*g*) Dengue:
- Admissions ... ... none.
- Deaths ... ... none.

7. Government dispensaries:—None.

8. Medical service:—
(*a*) Number of Government Medical Officers, 6.
(*b*) Number of Special Health Officers, none.
(*c*) Number of other registered practitioners, 3.

9. Schools:—
(*a*) Number of Government and State-Aided-Schools, 34.
(*b*) Number of scholars registered in these schools, 7,547.
(*c*) Percentages [? averages] of daily attendances, 3,612.

10. Estates employing indentured labour:—None.

11. Estimated revenue of Colony:—
Total during year, £48,583 3s. 1d.

12. Estimated expenditure of Colony:—
(*a*) Total during year, £49,204 8s. 6d.
(*b*) Annual medical and sanitary expenditure, £6,175 14s. 10d.
(*c*) Upkeep of Government hospitals and dispensaries, £7,593 16s.
(*d*) Total salaries and allowances of medical officers, £1,664 15s.
(*e*) Total annual sanitary expenditure, £4,510 18s. 10d.

13. Towns under municipalities or Town Council:—
(*a*) Number of such, 1.
(*b*) Total population, 9,262.
(*c*) Total revenues, £2,105.
(*d*) Total medical and sanitary expenditure, £4,448.

14. Table of deaths by districts:—

Districts.	Population.	Total Deaths.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1. St. John's ...	Estimated at 35,667.	67	49	37	36	31	32	35	44	34	48	67	57	537
2. St. Mary's ...		9	7	3	7	4	7	6	7	8	9	13	14	54
3. St. Paul's ...		7	12	3	11	10	4	11	5	7	9	12	11	102
4. St. Philip's ...		9	11	3	6	2	1	4	3	7	8	7	7	68
5. St. Peter's ...		7	8	5	8	7	7	2	5	6	7	8	13	83
6. St. George's ...		11	2	4	2	10	4	8	3	4	10	6	13	77
Total ...	... ...	110	89	55	70	64	55	66	67	66	91	113	115	961

15. Table of deaths in the principal towns:—

Town.	Population of Town.	Total Deaths.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
St. John's ...	9,262	58	43	30	23	21	27	27	35	25	26	55	38	408
Total ...	... ...	58	43	30	23	21	27	27	35	25	26	55	38	408

16. Rainfall during the year :—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1. Cades Bay ...	St. Mary's ...	3·92	2·28	2·24	1·73	1·62	3·17	2·33	4·44	6·09	7·55	3·01	3·84	42·22
2. Blakes ...	St. Paul's ...	3·93	2·46	2·26	4·25	1·73	2·00	3·00	4·20	5·55	4·03	3·20	2·64	40·25
3. Long Lane ...	St. Philip's	2·59	1·44	1·76	2·76	1·24	1·04	1·16	3·21	3·46	6·68	3·44	3·26	32·04
4. Parham New Work.	St. Peter's ...	3·41	1·36	1·20	2·71	1·34	0·67	2·49	3·20	4·82	6·57	4·78	2·13	34·76
5. Millers ...	St. George's	2·03	0·85	1·55	2·83	1·43	0·89	2·52	2·21	3·96	7·16	4·81	4·70	34·94
6. St. John's ...	St. John's ...	3·44	1·23	2·55	2·72	1·22	1·34	3·73	3·86	6·18	3·43	4·32	4·10	38·42

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises ?—Yes. Number of notices, convictions and warnings during the year, 47.

(*b*) Number of children examined for enlarged spleen. Where was this done ? Percentage affected. Does Kala Azar exist ?—None.

(*c*) Number of persons examined for filarial diseases. Where was this done ? Percentage affected ?—None.

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost ?—No.

(*e*) Number of men employed in towns and villages for petty anti-mosquito works, 29. Approximate cost, £4,510 18s. 10d.

(*f*) Amount of Government quinine sold or distributed gratis during the year,—£15. Agencies employed,—police stations.

(*g*) Is quinine distributed regularly in the schools ?—No.

(*h*) Measures taken against these diseases on estates employing indentured labour ?—None.

(*i*) Any steps taken regarding the housing of the poor ?—Boarding-out system and Poor-House.

(*j*) Any exceptional increase or decrease of these diseases recently noticed ? —No.

(*k*) Any other remarks on the subject ?—No.

St. Kitts-Nevis.

1. Colony of the Leeward Islands (Presidency of St. Kitts-Nevis).

2. Total area :—St. Kitts, 65 square miles. Nevis, 50 square miles. Anguilla, 35 square miles. Total, 150 square miles.

3. Estimated population :—

(*a*) Total, 43,303.
(*b*) Europeans,—not known.
(*c*) Other races,—not known.

4. Births during the year :—1,804.

5. Deaths during the year :—

(*a*) Total deaths, 1,243.
(*b*) Deaths ascribed to fever, 19.
(*c*) Deaths ascribed to blackwater fever, none.
(*d*) Deaths ascribed to yellow fever, none.

6. Government hospitals :—

(*a*) Number of hospitals, two.
(*b*) Totals during the year :

Admissions	1,046
Deaths	100

(*c*) Malarial fever :

Admissions	9
Deaths	1

(*d*) Blackwater fever:

Admissions	nil.
Deaths	nil.

(*e*) Yellow fever:

Admissions	nil.
Deaths	nil.

(*f*) Filarial diseases:

Admissions	64
Deaths	4

(*g*) Dengue:

Admissions	nil.
Deaths	nil.

7. Government dispensaries:—

(*a*) Number of such dispensaries, two.

8. Medical service:—

(*a*) Number of Government Medical Officers, eight.
(*b*) Number of Special Health Officers, two.*
(*c*) Number of other Registered Practitioners, none.

9. Schools:—

(*a*) Number of Government and State-Aided Schools, 52.
(*b*) Number of scholars registered in these schools, 9,907.
(*c*) Percentage of daily attendances, 50 per cent.

10. Estates employing indentured labour, none.

11. Estimated revenue of the Presidency, £49,249.

12. Estimated expenditure of the Presidency, £47,962.
(*b*) Annual medical and sanitary expenditure, £3,039.
(*c*) Upkeep Government hospitals and dispensaries, £6,843.
(*d*) Total salaries and allowances of medical officers, £2,032.
(*e*) Total annual sanitary expenditure, £1,007.

13. Towns under Municipalities or Town Councils:—

(*a*) Number of such, one.
(*b*) Total population, 8,000.
(*c*) Total revenues, nil.
(*d*) Total medical and sanitary expenditure, £925.

14. Table of deaths by districts:—

Districts.	Area.	Population.	Total Deaths.				
			Jan.—Mar.	April—June.	July—Sept.	Oct.—Dec.	Total.
	Square miles.						
St. Kitts	65	26,283	191	207	213	214	825
Nevis	50	12,945	76	55	64	128	323
Anguilla	35	4,075	15	13	28	39	95
Total ...	... ...	... ...	282	275	305	381	1,243

15. Table of deaths in the principal towns:—

Town.	District.	Population.	Total Deaths.				
			Jan.—Mar.	April—June.	July—Sept.	Oct.—Dec.	Total.
Basseterre ...	St. Kitts ...	8,000	81	68	88	75	312
Charlestown ...	Nevis ...	1,300	10	11	13	23	57
Total ...	... ...	... ...	91	79	101	98	369

* Also engaged in practice.

16. Rainfall during the year :—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Buckleys, Basseterre	St. Kitts	2·81	1·84	1·53	2·13	1·32	3·07	2·81	5·47	9·83	3·41	3·58	4·35	42·15
Cane Garden	Nevis ...	4·86	2·53	·97	·51	·90	4·82	2·51	8·14	7·54	1·70	3·11	3·95	41·54
Wall Blake	Anguilla	3·09	2·11	1·40	·84	·39	·22	2·05	6·58	3·50	2·71	3·85	5·61	32·35

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises ?—Yes. Number of notices, convictions and warnings during the year.—None.

(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected.—This is not done. Does Kala-azar exist ?—No.

(*c*) Number persons examined for filarial diseases. Where was this done? Percentage affected.—From an examination made in 1901, it was estimated that 30 per cent. of persons were affected.

(*d*) Any large works for surface drainage of towns or reclamation of marshes ?—Draining swamp to east of town of Basseterre. Approximate cost, £1,000.

(*e*) Numbers of men employed in towns or villages for petty anti-mosquito works.—None.

(*f*) Amount of Government quinine sold or distributed gratis during the year.—None. Agencies employed.—None.

(*g*) Is quinine distributed regularly in the schools ?—No.

(*h*) Measures taken against these diseases on estates employing indentured labour.

(*i*) Any steps taken regarding the housing of the poor ?—None.

(*j*) Any exceptional increase or decrease of these diseases recently noticed?

(*k*) Any other remarks on the subject ?—Malaria, not being endemic in the Presidency, no special anti-malarial measures, such as the distribution of quinine, have been undertaken. Filarial diseases are very prevalent, and an Ordinance has been introduced to aid in the destruction of mosquitoes; apathy on the subject is very great, and it will take some time ere much good results. The two dispensaries in the Presidency are for the treatment of cases of yaws.

W. H. FRETZ, L.R.C.P., L.R.S.E.,
Senior Medical Officer.

St. Kitts,
4th May, 1911.

Dominica.

1. Name of Colony : Presidency of Dominica.

2. Total area : 304⅝ square miles.

3. Estimated population :—

(*a*) Total, 33,863.
(*b*) European, 399.
(*d*) Other races : Black, 21,361; coloured, 12,103.

4. Births during the year :—

Total births, 1,306.

5. Deaths during the year :—

(a) Total deaths, 782.
(b) Deaths ascribed to fever
(c) Deaths ascribed to blackwater fever
(c) Deaths ascribed to yellow fever
} unknown.

6. Government hospitals :—

(a) Number of such hospitals, two.
(b) Totals during year :

Admissions	756
Deaths	49

(c) Malarial fever :

Admissions	60
Deaths	3

(d) Blackwater fever :

Admissions	—
Deaths	—

(e) Yellow fever :

Admissions	—
Deaths	—

(f) Filarial diseases :

Admissions	1
Deaths	—

(g) Dengue :

Admissions	—
Deaths	—

7. Government dispensaries :—

(a) Number of such dispensaries, 14.
(b) Total attendances during year, 8,872.
(c) Attendances for malaria, 577.
(d) Attendances for filarial diseases, 3.
(e) Attendances for dengue, nil.

8. Medical service :—

(a) Number of Government Medical Officers, 5.
(b) Number of special Health Officers, none.
(c) Number of other registered practitioners, nil.

9. Schools :—

(a) Number of Government and State-Aided Schools : 20 Government, 3 aided.
(b) Number of scholars registered in these schools : 4,453 Government, 337 aided.
(c) Percentage of daily attendances, 48.

10. Estates employing indentured labour, nil.

11. Estimated revenue of Presidency :—

Total during year 1910-11, £41,472 14s. 9d.

12. Estimated expenditure of Presidency :—

(a) Total during year, £39,050 0s. 6½d.
(b) Annual medical and sanitary expenditure, £1,834 11s. 7d.
(c) Upkeep of Government hospitals and dispensaries, £1,870 1s. 2d.
(d) Total salaries and allowances of medical officers, £1,468 19s. 2d.
(e) Total annual sanitary expenditure, £175 4s. 5d.

13. Towns under municipalities or town councils :—

(a) Number of such, one (Roseau).
(b) Total population, 6,577.
(c) Total revenues, £1,322 8s. 4d.
(d) Total medical and sanitary expenditure, £282 12s. 5d.

14. Table of deaths by districts :—

District.	Area.	Population.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
E	101⅚	15,537	41	30	39	47	51	51	27	24	33	39	25	33	440
F	73	9,426	14	14	15	21	5	12	12	13	8	12	10	10	146
G	129⅚	8,900	24	17	12	17	21	14	14	14	17	12	20	14	196
Total ...	304⅔	33,863	79	61	66	85	77	77	53	51	58	63	55	57	782

15. Table of deaths in the principal towns :—

Town.	District where situated.	Population of Town.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Roseau ...	E	6,577	24	12	18	30	27	25	19	16	16	20	7	15	229
Portsmouth	G	1,023	3	5	5	5	6	3	4	3	4	4	6	5	53
Total ...	—	7,600	27	17	23	35	33	28	23	19	20	24	13	20	282

16. Rainfall during the year :—

Station.	January	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Agricultural School	5·92	13·96	1·13	3·45	8·21	14·95	13·55	10·64	8·72	3·89	5·41	8·30	98·13
Antrim Valley	6·10	14·36	3·63	5·72	9·92	23·05	22·37	15·05	10·50	5·07	6·78	13·14	135·69
Batalie	1·77	3·46	2·00	4·11	3·91	4·83	16·37	6·84	3·15	5·38	3·78	3·72	59·32
Bellevue	9·78	16·08	5·95	4·42	19·61	22·53	16·51	17·48	17·78	6·93	12·49	16·55	166·11
Blenheim	4·80	5·84	4·73	5·57	23·84	10·91	11·24	10·38	17·54	8·58	8·34	9·05	120·82
Botanic Station	5·20	11·42	1·16	2·86	7·30	14·26	12·60	10·22	8·90	3·82	5·40	7·50	90·64
Canefield	4·01	9·62	1·16	2·31	6·84	16·42	14·59	9·36	7·07	3·07	5·48	6·72	86·65
Castleacre	7·35	11·76	6·07	3·07	9·89	25·13	21·91	14·76	11·14	5·42	7·43	12·59	136·52
Castle Bruce	4·40	2·52	4·35	6·40	16·65	15·89	9·40	8·40	10·75	16·26	16·26	5·70	116·98
Corlet	12·56	22·53	8·69	6·86	22·80	29·20	25·67	26·50	21·29	7·74	12·95	22·90	219·69
Everton	4·76	6·59	3·72	2·17	8·36	26·20	10·79	11·36	10·14	4·47	5·26	11·75	105·57
Goodwill	3·68	10·74	1·10	2·78	7·27	14·06	11·16	9·57	9·18	3·25	5·14	6·24	84·17
Governor	8·05	6·16	5·56	5·83	26·51	12·39	13·04	16·06	20·69	12·06	7·15	15·62	149·12
Gleau Manioc	16·11	16·87	16·57	13·61	47·11	35·44	28·89	35·25	26·41	17·59	15·40	33·31	302·56
Hillsborough	4·06	7·81	1·59	2·53	9·62	18·22	13·72	9·85	6·35	3·12	5·67	6·48	89·02
Hatton Garden	4·45	3·33	5·35	3·12	18·80	6·86	8·16	10·81	14·90	8·62	5·29	8·05	97·74
Hampstead	3·19	4·61	4·00	3·19	22·18	8·12	7·36	10·01	12·03	9·25	8·19	7·90	100·03
Kinellan	9·17	16·55	5·64	9·44	23·05	22·83	22·33	19·06	15·52	7·94	8·14	18·87	178·54
La Haut	5·67	7·88	1·49	2·93	9·67	18·36	11·25	10·23	13·43	4·33	7·43	13·24	105·91
Lancashire	18·17	31·06	15·03	13·02	31·55	27·44	32·63	16·56	21·26	5·06	14·14	22·43	248·35
Lisdara	8·25	13·56	7·04	3·93	19·54	23·76	16·53	18·51	19·61	6·12	9·98	19·24	166·07
Londonderry	4·58	3·23	2·59	3·03	17·51	6·56	6·45	12·62	13·11	7·89	6·41	6·90	90·88
Long Ditton	16·60	20·11	16·87	11·26	32·16	37·70	30·49	20·89	25·32	12·39	11·15	24·79	259·73
Melville Hall	6·25	4·35	3·73	3·15	19·66	7·90	9·93	14·35	13·84	8·66	7·12	7·81	166·75
Macoucherie	3·87	5·90	3·86	5·58	8·14	15·19	9·42	5·77	3·57	5·92	1·92	4·11	73·25
Moore Park	4·83	5·53	6·80	4·22	23·97	11·93	10·21	14·83	14·87	8·10	8·95	9·36	123·60
Point Mulatre	11·23	5·56	6·22	5·25	28·52	10·42	10·22	16·03	16·99	6·80	14·50	7·39	139·13
Picard	4·08	7·12	8·08	5·50	14·35	17·74	12·42	11·55	10·56	4·87	4·60	7·46	108·33
Rosalie	8·49	4·00	7·62	3·75	24·97	12·78	12·99	14·08	17·63	6·92	8·83	9·23	131·29
Saltoun	12·38	22·31	12·04	11·11	36·34	31·65	29·54	23·60	18·10	8·12	11·99	24·00	241·18
Shawford	9·09	16·01	6·40.	6·57	16·66	34·63	23·18	12·65	17·51	6·88	10·59	20·22	180·39
Snug Corner	...	14·34	2·32	3·36	13·93	10·72	12·45	12·85	14·83	7·13	10·07	11·18	...
St. Aroment	6·50	11·54	3·15	4·74	8·00	13·80	13·52	11·25	9·06	3·98	5·14	8·21	98·89
Soufrière	...	...	...	...	11·51	11·91	15·00	7·30	11·40	4·13	5·55	6·62	...
Woodford Hill	5·05	3·75	3·20	2·79	20·75	6·87	9·68	10·33	14·54	10·00	8·05	6·19	101·20
Wall House	2·35	4·91	2·90	1·20	5·55	13·12	8·93	9·80	8·80	2·60	3·35	8·30	71·81

Mean Rainfall 34 Stations, 136·59 inches.
" " 12 Leeward Coast Stations, 89·31 inches.
" " 3 Windward " " 129·13 "
" " 14 Inland Stations, 187·74 "
" " 5 La Soye Coast Stations, 111·32 "

17. Additional information to be given if possible on the following points:—
(a) Is there any legislation in force against the breeding of mosquitoes in premises?—No.
(b) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does Kala-azar exist? ——
(c) Number of persons examined for filarial diseases. Where this was done? Percentage affected.—Unknown.
(d) Any large works for surface drainage of towns or reclamation of marshes.—None.
(e) Numbers of men employed in towns and villages for petty anti-mosquito works.—None.
(f) Amount of Government quinine sold or distributed gratis during the year.—42 gross pills.
Agencies employed.—Country police stations.
(g) Is quinine distributed regularly in the schools?—No.
(h) Measures taken against these diseases on estates employing indentured labour?—No indentured labour.
(i) Any steps taken regarding the housing of the poor.—None.
(j) Any exceptional increase or decrease of these diseases recently noticed.—None.

No. 21.

WINDWARD ISLANDS.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received 2 May, 1911.)

SIR, Grenada, 5th April, 1911.

I HAVE the honour to acknowledge the receipt of your circular despatch of the 20th December last,* regarding the preparation of the returns of mosquito-borne diseases suggested by Professor Ross, in connection with which the three Colonies of the Windward Group have been addressed.

2. The position of all three Colonies is the same with regard to medical arrangements: we have no Colonial Surgeon for the Windward Islands nor a Colonial Surgeon in any of the Islands. The Medical Officers, too, are partly Government officers and partly private practitioners, on whose time a heavy call is made by the system obtaining in these Islands, whereby the doctor generally goes to the patient instead of the latter to the doctor.

3. Under these circumstances, I fear it would be useless to promise that complicated returns could be prepared in any of these Colonies in anything like the comprehensive form suggested by Professor Ross until the Windward Islands are in a position to afford the services of an Administrative Medical Officer.

4. In the meanwhile each Colony will do what it can to make the returns more comprehensive than they are at present.

5. I may add that considerable attention is being paid to mosquito-borne diseases, and that in Grenada, on a suggestion by the Honourable J. Paterson in the Legislative Council, a Committee is about to be formed to consider the whole question of these diseases and the manner in which they may be best combated.

I have, &c.,
J. HAYES SADLER,
Governor.

No. 22.

FIJI.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1ST JANUARY TO THE 31ST DECEMBER, 1910.

(Received October 30, 1911.)

1. Name of Colony: Fiji.
2. Total area: 4,953,920 acres.

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* No. 11 in Appendix I. in [Cd. 5514].

3. Estimated population :—
   (*a*) Total : 137,762.
   (*b*) Europeans : 3,417.
   (*c*) ——
   (*d*) Other races : 134,345.
   (*e*) ——

4. Births during the year :—
   Total births : 5,145.

5. Deaths during the year :—
   (*a*) Total deaths : 4,885.
   (*b*) Deaths ascribed to fever. Malarial fever : Nil.
   (*c*) Deaths ascribed to blackwater fever : Nil.
   (*d*) Deaths ascribed to yellow fever : Nil.

6. Government Hospitals :—
   (*a*) Number of such hospitals : 11.
   (*b*) Total attendances during the year : admissions, 5,833; deaths, 242.
   (*c*) Malarial fever : admissions, 4; deaths, Nil.
   (*d*) Blackwater fever : admissions, Nil; deaths, Nil.
   (*e*) Yellow fever : admissions, Nil; deaths, Nil.
   (*f*) Filarial diseases : admissions, 153; deaths, 2.
   (*g*) Dengue : admissions, 78; deaths, Nil.

7. Government Dispensaries :—
   (*a*) Number of such dispensaries : No Government dispensaries.
   Native medical practitioners : 35 native medical practitioners distributed through the Colony who attend to native patients in their houses.

8. Medical Service :—
   (*a*) Number of Government Medical Officers : 20.
   (*b*) Number of special Health Officers : 1.
   (*c*) Number of other registered practitioners : 2.

9. Schools :—
   (*a*) Number of Government and State-aided Schools : 3.
   (*b*) Number of scholars registered in these schools : 364.
   (*c*) Percentage of daily attendances : 279·7 [*sic.*].

10. Estates employing indentured labour :—
   (*a*) Number of such : 154.
   (*b*) Number of indentured labourers employed : 13,954.
   (*c*) Number of hospitals and dispensaries on such estates : 21.
   (*d*) Total deaths among such labourers : 560.
   (*e*) Deaths ascribed to malaria : Nil.
   (*f*) Total admissions and attendances at hospitals and dispensaries : 17,896 —includes children.

11. Estimated revenue of Colony :—
   Total during year : £182,733.

12. Estimated expenditure of Colony :—
   (*a*) Total during year : £211,952 5s. 2d.
   (*b*) Annual medical and sanitary expenditure : £24,726 1s. 8d.
   (*c*) Upkeep of Government hospitals : £8,502 1s. 8d.
   (*d*) Total salaries and allowances of Medical Officers : £7,593 5s.
   (*e*) Total annual sanitary expenditure : £720.

13. Towns under municipalities or town councils :—
   (*a*) Number of such : 2.
   (*b*) Total population : 5,770.
   (*c*) Total revenues : £8,442 5s. 9d.
   (*d*) Total medical and sanitary expenditure : £1,334 15s. 4d.

14. Table of deaths by Districts : Statistics not obtainable.

15. Table of deaths in the principal towns : Ditto.

16. **Monthly Rainfall, Fiji, 1910.**

STATION.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Suva	6·92	11·57	12·04	3·87	14·12	9·89	3·13	8·96	12·91	19·33	12·73	9·59	125·06
Ba	14·39	23·37	14·04	5·85	9·92	3·60	1·06	2·24	7·20	5·08	6·01	8·93	101·69
Baulailai	15·39	15·57	37·15	11·27	13·96	2·66	1·02	4·16	3·12	2·90	4·73	6·15	118·08
Labasa	11·69	21·22	49·57	11·08	8·99	2·85	2·61	0·75	8·45	3·65	9·74	16·69	147 29
Lautoka Exp. Station ...	12·73	20·14	15·18	6·52	9·42	3·17	2·25	3·34	4·08	6·40	4·19	7·64	95·06
Kadavu	3·20	5·88	8·13	7·13	5·62	5·72	5·59	10·07	3·17	4·54	7·32	5·11	71·48
Levuka	3·20	10·34	12·74	7·23	6·69	10·20	2·08	6·45	15·90	6·82	10·54	3·81	96·00
Munia	6·24	14·52	22·49	7·56	9·96	1·44	0·30	3·92	6·33	5·45	5·60	9·69	93·50
Nadarivatu	12·97	22·08	30·12	1·89	8·12	1·54	4·36	2·95	3·25	3·33	11·23	9·89	111·73
Nadi	8·58	9·64	13·72	3·52	6·93	2·67	2·25	2·91	3·22	4·31	5·04	7·14	69·93
Nadroga	5·56	10·28	13·41	5·50	7·54	3·95	2·30	4·73	0	2·17	9·50	4·10	69·04
Nasinu Exp. Station ...	5·69	11·75	14·20	5·07	15·81	13·31	3·98	9·69	12·16	20·49	15·42	12·02	139·59
Navua	11·69	18·94	11·75	8·39	22·12	12·04	5·31	12·09	21·22	9·44	32·33	15·40	180·72
Rabi	20·75	16·47	44·04	15·60	14·64	7·34	3·95	6·64	11·73	14·59	20·45	30·75	206·95
Raki Raki	4·56	15·51	18·50	7·66	13·73	2·08	0·72	2·29	3·00	3·59	9·32	9·62	90·58
Rewa (Muanaweni) ...	10·92	13·09	16·44	8·40	14·18	9·13	1·84	9·87	12·26	19·44	28·34	16·62	160·53
Rewa (Nausori)	6·66	14·06	12·40	5·39	12·54	13·15	2·64	8·09	9·01	14·47	16·79	11·51	126·71
Savu Savu Bay	4·49	10·70	40·29	5·00	7·86	6·41	2·44	6·76	18·14	12·36	12·52	13·44	140·41
Taviuni	3·02	8·51	32·90	12·45	8·75	3·13	0·74	5·28	11·64	11·12	10·42	14·88	122·84
Tailevu	7·53	11·33	13·36	10·48	6·01	10·37	0·92	11·25	9·10	15·62	18·80	13·43	128·20
Wainunu	10·19	16·97	42·56	12·62	13·52	7·77	3·20	6·72	20·56	14·06	20·74	25·03	193·94
Totals	186·37	301·94	475·03	162·48	230·43	132·42	52·69	129·16	196·45	199·16	271·76	251·44	2589·33

17—

(*a*) There is at present no legislation in force against the breeding of mosquitoes. The Committee appointed to make suggestions for a new Public Health Ordinance asked that provision be made giving power to the Board of Health to make regulations for prevention of breeding of mosquitoes.

(*b*) None. There is no malaria except that imported and the anopheles. Kala-azar does not exist.

(*c*) It is not possible to give the figures for these examinations. Large numbers are examined at the Colonial Hospital and Provincial hospitals from year to year.

(*d*) No large works but minor work of canalisation was done in the town of Suva. The work was done by a prison gang under a European warder at £150 per annum.

(*e*) Nil, except as in (*d*).

(*f*) None for malaria; quinine is only issued in small quantities for other diseases.

(*g*) No.

(*h*) Improvement in water supplies and sanitation generally under Municipal Ordinance Regulations for the improvement of the general health of the indentured labour, not specially directed against these diseases.

(*i*) None.

(*j*) No exceptional change in either direction.

(*k*) There is no malaria in Fiji except a stray case brought in by newly-arrived Indian immigrants. There is no blackwater fever or yellow fever. Filarial disease is common among Fijians, rare in Europeans.

Dengue fever is seen in small more or less severe outbreaks yearly, frequently modified in its course so that it is often with difficulty recognised.

G. W. A. LYNCH,
Chief Medical Officer.

APPENDIX II.

Report of the Professor of Protozoology at the University of London for the year 1910–11.

I. General.

Miss Muriel Robertson, who has been one of my assistants since the beginning of 1909, resigned her appointment in May of this year in order to go to Uganda and undertake special researches upon the etiology of Sleeping Sickness and kindred

problems. While greatly regretting the loss (which I hope will only be temporary) of her valuable assistance in this department, I am rejoiced that Miss Robertson has been given this opportunity of employing her talents in researches of such great importance, both from the practical and scientific point of view, and hope that her investigations may be crowned with success.

Miss Robertson's resignation sets free £50 of the annual grant of £200 allotted to me for payment of assistants. Being unable to fill up this post by a suitably-qualified person, I have recommended that Dr. Woodcock's salary should be increased by £50, and that he should be my sole assistant. This recommendation has received the approval of the University.

During the whole year covered by this report, I have been working at the Lister Institute.

II. Special.

1. *Research.*—During the past year I have been occupied, almost to the exclusion of other lines of investigation, in collaborating with Dr. J. D. Thomson in researches upon the transmission of *Trypanosoma lewisi* by, and its development in, the rat-flea, *Ceratophyllus fasciatus.* These are two problems which though, of course, intimately connected, are yet in a measure distinct, especially as regards the methods of investigation required; the problem of the transmission requires to be attacked experimentally, while tracing out the developmental sequence of the parasite in the flea is mainly a matter of observation. It is, however, indispensable to study the two problems side by side, since the results obtained from the one elucidate the difficulties presented by the other. In my reports for former years ([Cd. 4476], p. 24, [Cd. 4999], p. 45, and [Cd. 5514], p. 25), I have dealt at length with the objects of this research and with the results then obtained. It will, therefore, suffice if I now give an account of the special points that have occupied us during the past year, which I will discuss briefly under the respective headings of *transmission* and *development* of the trypanosome.

(a) *Transmission.*—From the investigations both of ourselves and of others, it may, we think, be taken as completely established that the rat-flea transmits *Trypanosoma lewisi* from infected to " clean " rats, and that in this process of transmission the following series of events occurs: (1) The flea, sucking the blood of the infected rat, takes up the trypanosomes through its proboscis and passes them on into its digestive tract, together with the blood; (2) the parasite goes through a developmental cycle in the interior of the flea lasting about six days, at the end of which period the flea is capable of infecting a clean rat; (3) when the developmental cycle of the trypanosome in the flea is complete, the final, or, as it may conveniently be termed, the " ripe " form of the parasite passes back from the flea into the rat and so produces a fresh infection.

Such being the general course of events, a number of questions with regard to points of detail suggest themselves; and in the first place, how does the parasite pass from the flea into the rat? This is a question of considerable importance, not only with regard to the transmission of trypanosomes, but also in its bearing upon the problem of the transmission of other parasites through the agency of fleas. For example, the precise manner in which the plague-bacillus is transmitted by fleas is one which has been the subject of much investigation, and which is not, I believe, established decisively. If, therefore, the manner in which the flea transmits trypanosomes to rats could be made out definitely, it might furnish an important clue towards solving the problem of the transmission of plague to rats and human beings by fleas also.

Considering the problem first in a general and purely abstract manner, there are known to be two methods by which vertebrate animals acquire infection by blood-parasites. The first may be termed briefly the *contaminative* method, in which the vertebrate acquires the infection, as it were, accidentally, by eating substances containing the parasite, which thus passes into the mouth or the digestive tract of the vertebrate and thence into its blood. An example of this method of infection has been demonstrated in the case of another blood-parasite of rats, a hæmogregarine which is found in the leucocytes, and hence often termed a Leucocytozoon. It has been proved experimentally by the American investigator, W. W. Miller, that this hæmogregarine is taken up from the rat by a species of mite which sucks the rat's blood; that the parasite goes through a developmental cycle in the mite; and that the ripe form of the parasite in the mite can only pass back into the rat if the mite be caught and eaten by the rat, an event which occurs

frequently when rats are much troubled by the attentions of the mites. Then the body of the mite is digested in the intestine of the rat, but the ripe stages of the parasite, if present in the mite, are able to resist digestion and are set free; they pass into the liver of the rat, establish themselves and multiply there, and finally complete the life-cycle by passing into the blood-vessels, where they are taken up by the leucocytes, in which they remain in an encapsuled condition.

The second method of infection may be termed briefly the *inoculative*; in this case, after the parasite has completed its developmental cycle in the invertebrate blood-sucking host, it is inoculated by the invertebrate into the blood of the vertebrate host. The classic example of this method of transmission is furnished by the well-known developmental cycle of the malarial parasites in the mosquito. In this case, if the mosquito acquires an infection by sucking the blood of an infected vertebrate, the parasite goes through a complicated life-cycle in the mosquito which culminates in the appearance of a vast number of minute germs, the ripe stage of the parasite, in the salivary glands of the mosquito. Then, when the mosquito next sucks the blood of a suitable vertebrate host, the tiny germs pass in large numbers from the salivary glands down the proboscis of the mosquito into the blood of the vertebrate, and so produce a new infection of the latter. The example which has been cited, however, of the malarial parasites does not necessarily exhaust the possibilities of the inoculative method of transmission; it is quite conceivable that the ripe forms of the parasite might pass out of the invertebrate host, not forwards through the mouth, but backwards through the anus, by being voided with the fæces; in which case the infective stage of the parasite might be scattered on the skin of the vertebrate and might then get into its blood either by working their way through the skin, or by passing through a wound or abrasion of the cuticle, possibly through the puncture made by the proboscis at the moment of feeding.

Thus, to sum up briefly the possibilities of the case, the flea might infect the rat *contaminatively*, that is to say, by way of the mouth, through the rat catching and eating infected fleas, or licking from its skin flea-fæces containing the ripe, infective stages of the parasite; or *inoculatively*, by way of the skin, through the parasite passing from the mouth of the flea into the puncture made by the proboscis at the time of feeding, or from the anus of the flea on to the skin of the rat and thence into its blood. The problem now is to determine which of these abstractly-possible methods of infection and transmission occur actually; a problem which must be attacked experimentally, since it is not possible to observe the actual passage of the parasites from the flea to the rat, as Miss Robertson was able to do in her investigations on the transmission of the trypanosomes of fishes by leeches, reported below (p. 81). It must further be borne in mind that to prove the occurrence of one method of transmission by no means precludes transmission by other means also, and that consequently each possible means of transmission must be tested independently.

Our experiments and investigations upon the method of infection are still proceeding, and have not yet reached a point at which we can pronounce decisively upon all the questions involved; we have, however, obtained a number of results which throw a certain amount of light upon the problem, and which I may summarise briefly. In the first place, we found by direct experiment that rats could become infected by eating infected fleas. The same discovery was made independently by Mr. Strickland, of the Quick Laboratory, Cambridge, who, however, drew conclusions from the fact with which we are unable to agree. Mr. Strickland appears to consider this to be the usual and normal manner in which the infection is brought about. We, on the other hand, regard this method of infection as an exceptional or accidental occurrence, and by no means as that by which the parasite is transmitted ordinarily, for the following reasons:—(1) We have performed a number of experiments in which fleas taken from the infected breeding-cage* were placed singly each on a healthy rat for a certain time in a suitable cage, then recovered and dissected, and the contents of the digestive tract examined microscopically; in a number of cases the rat showed infection in due course; (2) we have performed other experiments in which a flea, taken from the infected breeding-cage, was put for a certain time on a healthy rat, then recovered and put on another healthy rat, and then again on a third, and so on, as long as the flea remained alive, great care being taken to be sure that the rats used did not carry any other fleas

* By an infected breeding-cage is meant a breeding-cage for fleas in which a well-infected rat is always kept, so that every time the fleas feed they take in blood containing trypanosomes.

than the one used for the experiment; in these experiments every rat used did not become infected, but a great many did, and thus we were able to infect several rats with one and the same flea. From these two series of one-flea experiments, in which the flea was recovered alive after it had effected the infection of the rat, it appears to us to follow most conclusively that it is not necessary for the rat to eat the flea in order to become infected by it. We have set forth these conclusions, with an account of the experiments upon which they are based, in a short article contributed to the British Medical Journal (No. 3 below).

We have also performed a number of experiments to ascertain whether the infection is contained in the fæces of the flea, and with this object we have fed healthy rats with food contaminated with the fæces of fleas from the infected breeding-cage. A large number of such experiments continued over a considerable time have given negative results throughout, and indicate, therefore, that the rat cannot become infected by eating the fæces of infected fleas. This result does not, however, preclude the possibility that the fæces might produce an infection if they came in contact with a scratch or lesion on the skin; this is a point which we intend to test by experiment as soon as possible.

At the present time we are experimenting with fleas by feeding them singly on rats and keeping them under observation during the whole time; that is to say, the rat having been immobilised, the fleas are put on one at a time and carefully watched in order to ascertain whether they feed, each flea being re-captured as soon as it has done so, or at once if it will not feed. The object of these experiments is to ascertain whether the infection is brought about by the parasite passing actually down the proboscis into the blood of the rat, or whether, on the other hand, the infection is due to the wound of the proboscis becoming contaminated by the fæces of the flea, or in some other way. We are carrying on these experiments in consultation with Dr. C. J. Martin, the Director of the Lister Institute, who is performing similar experiments with fleas infected with plague. As the experiments are still proceeding, I am not in a position to report on the results at present; I hope to do so in my next report.

Finally, the question arises, with regard to the transmission of the parasite, whether it can take place hereditarily in the flea; that is to say, whether the off-spring of an infected flea may be born themselves infected. To test this question, two breeding-cages were stocked with the off-spring of fleas from the infected breeding-cage. One cage was stocked with over 2,000 larvæ of fleas from the infected breeding-cage. To stock the other cage, fleas were collected daily from the infected breeding-cage and placed in glass-capsules; the next morning a certain number of fleas' eggs were found in the capsule; these eggs were collected and placed in another capsule, where, in due course, flea-larvæ hatched out of them, the larvæ were then transferred to the breeding-cage, where they were supplied with food and developed into fleas; the second breeding-cage was stocked in this way with about 150 flea-larvæ, all of them hatched from eggs laid by fleas from the infected breeding-cage. As soon as adult fleas made their appearance in these cages, a healthy rat was put in. The experiments were continued for some months, but the results in both cases were quite negative, and indicate that trypanosomes are not transmitted from parent to offspring in the fleas. I may point out here, that this is a consideration of some importance in the general problem of the transmission of trypanosomes; for practical purposes it is important to know whether trypanosomes can pass from one generation to another of the insects that carry them. It has often been asserted, on purely general grounds or on analogies with other parasites, that hereditary transmission of this kind can or must take place, in the case of trypanosomes; but positive experimental proof has never been brought forward of any such transmission taking place; and, so far as it is permissible to draw general conclusions from experiments which yield negative results, it would appear that trypanosomes are not transmitted from parent to offspring in insect-carriers. A similar result was obtained by Miss Robertson with regard to the trypanosomes of fishes in the transmitting leeches (*see* below, p. 81).

(b) *Development.*—From results previously obtained and reported on by us (*vide* [Cd. 5514], p. 25), the following points may, I think, be taken as definitely established:—(1) The trypanosome goes through a development in the flea lasting about six days, at the end of which time, but not before, the flea is capable of infecting a rat with trypanosomes; (2) the principal developmental phase of the parasite is the active multiplication of minute, *Crithidia*-like forms attached usually to the wall of the rectum, sometimes to that of the pylorus or intestine, of the flea.

Taking the rectal *Crithidia* (as it may be called for short) as the middle phase of the development, it remains to investigate the beginning and the end; that is to say, to find out how the trypanosome taken up from the rat's blood becomes changed into the *Crithidia*, which differs greatly from it both in size and structure, and how the final or " ripe " form, which passes back from the flea into the rat, arises from the crithidial form. The second of these two questions involves the further question, what is the final form of the development in the flea? Messrs. Strickland and Swellengrebel, in their studies on the development of *Trypanosoma lewisi* in the rat-flea, have identified as the final developmental form certain small, stumpy trypanosome-forms, which are connected by every possible gradation of form with the crithidial forms, and arise, without doubt, from them in rectum. Our results, as will be seen, support the conclusions of these investigators with regard to this point.

During the latter half of 1910, we were occupied almost entirely with experiments and observations upon the final stages of the development, a problem which is, of course, intimately connected with the problems of transmission discussed in the foregoing section. The first question which arises is, in what part or organ of the flea, when it is infective, is the ripe stage of the trypanosome to be sought for? This is a problem which requires to be solved chiefly by experimental methods, guided by the known facts of the development and transmission of other species of trypanosomes. It is known, for example, that some trypanosomes penetrate into the salivary glands of their insect-carriers, and pass thence down the proboscis into the vertebrate host when the insect sucks blood, in the same way as does the malarial parasite in the mosquito. Consequently, our first observations were directed towards the salivary glands and the proboscis of the flea. We made preparations of a great number both of salivary glands and of proboscides, and searched them carefully, but could find nothing whatever which we could identify as a stage of the trypanosome. We then started our series of single-flea experiments, and after a flea taken from the infected breeding-cage had been fed on a healthy rat, the flea was recovered, dissected, and preparations made of all its organs; in many cases, as stated above, the rats showed infection subsequently, so that we had in our possession preparations of the salivary glands and other organs of fleas which had infected rats just previously to being dissected; but the most careful and laborious search of the preparations of the salivary glands revealed no stages of the parasite. We then approached the problem by a different method: a certain number of fleas, some ten or a dozen in each experiment, were collected from the infected breeding-cage and dissected very carefully; the salivary glands of the fleas were extracted and placed by themselves all together in a capsule in a small quantity of salt-citrate solution; the stomachs were placed similarly all together in a second capsule; the hindguts in a third; and the proboscides in a fourth; when the dissections were completed, all the salivary glands were injected into the blood of one clean rat, all the stomachs into a second, all the hindguts into a third, and all the proboscides into a fourth. The results of these experiments were very uniform: in nearly all cases, the rat which had been injected with the stomachs of the fleas became infected; that which had been injected with the hindguts, sometimes; but those which had been injected with salivary glands or proboscides, never. From all these observations and experiments, we consider it to be as definitely established as a negative proposition ever can be, that the trypanosome does not pass at all into the salivary glands of the flea, and is not to be found, under ordinary circumstances, in the proboscis; a conclusion which does not, of course, preclude the possibility that the trypanosomes may pass through the proboscis when the act of infection by the flea takes place. From this time onwards we did not trouble ourselves any more to examine, or experiment with, the salivary glands or proboscis of the flea. I venture to take this opportunity of pointing out how much time and labour may be expended, in researches of this kind, in the effort to establish purely negative propositions. A single fortunate experiment or observation may be the means of discovering a positive fact or principle; a negative conclusion can never be regarded as established, strictly speaking, but only as having acquired a greater or less degree of probability, since a single positive instance to the contrary suffices to upset it completely.

The experiments mentioned in the foregoing paragraph indicated that the ripe form of the parasite in the flea was to be sought for chiefly in the stomach, but also in the hindgut. We then carried out two other sets of experiments planned to throw further light upon this point. In the first series, fleas taken from the infected breeding-cage were dissected one by one, and the stomach of each flea was teased up in a little drop of salt-citrate solution on one slide, the rectum on another; the

debris of the stomach was then drawn up into a syringe from the slide and injected into a clean rat, after which all that was left on the slide, that is to say, any moisture or debris which did not pass up into the syringe, was preserved and stained as a permanent preparation, and put away to await results; the drop in which the rectum had been teased up was not injected into a rat in every case, but only if trypanosomes were seen in it by a cursory microscopic examination. As a result of these experiments, many of the rats which had been injected with the stomachs of single fleas became infected with trypanosomes in due course, and in some cases also those which had been injected with the recta. When this result had been attained, we had in our possession preparations of the contents of the actual stomach or rectum by which the infection had been produced; and in all such cases we were able to find the little stumpy forms of the trypanosome in the preparations.

In a second series of experiments, a large number of fleas were taken from the non-infected breeding-cage and put into a special tin cage with a well-infected rat. Two days later ten of these fleas, recovered on the previous day, were dissected and examined, the stomach of each being placed on one slide, the rectum on another; in each case a little of the contents of the stomach or rectum were allowed to escape on to the slide, in order to make permanent preparations of the contents; then the stomachs were placed all together in one capsule and injected into a healthy rat, and similarly the recta were injected into another rat. The same procedure was carried out with ten more fleas of the same batch on the next and subsequent days; altogether the dissections and injections described were performed at periods two, three, four, five, seven and ten days after the date on which the fleas were put on the infected rat, ten fleas being used each time. The experimental results were as follows :—None of the rats became infected which were injected with any contents of fleas dissected two, three, or four days after they were exposed to infection; the first infection obtained was a rat which had been injected with the recta of the fleas in which the infection was five days' old; a similar result was obtained with the fleas of the seventh day, the recta, but not the stomachs, producing an infection; on the tenth day, however, the stomachs injected produced an infection, but not the recta. Comparing now these results with the permanent preparations made when the fleas were dissected, it was found that in the fleas of the second, third, and fourth days trypanosomes were present of various types, but the little stumpy forms were not found; this type first made its appearance in the recta on the fifth day, and its appearance coincided with the first infection obtained. Permanent preparations were not made, unfortunately, of the fleas dissected on the seventh and tenth days, though trypanosomes were seen in them in the fresh condition. The experiments show clearly, however, that when the trypanosomes are undergoing development in the flea, they become changed in their properties in such a way that they are no longer capable of infecting the rat when injected into its blood; not until the development of the parasite is complete does it become ripe for producing an infection in the rat, and the acquisition of infective powers coincides with the appearance of the little stumpy trypanosome-type, which appears in the rectum five days after the flea has been infected, but which does not get so far forward as the stomach until the sixth or seventh day.

From the experiments and observations described, we are of opinion that the final form of the development of the trypanosome is the little stumpy form, as supposed by Messrs. Strickland and Swellengrebel; that this form is produced in the rectum by modification of the crithidial form; and that from the rectum it passes forward to the stomach, but is never found further forward than this, neither in the proboscis nor the salivary glands. The facts appear to indicate strongly that infection of the rat is brought about by the regurgitation of the ripe form from the stomach at the time the flea feeds, but the occurrence of this form in the rectum leaves the possibility open that it may also pass out with the fæces. It will be the object of further experiments to test carefully the exact mode in which infection takes place.

Recently we have been paying more attention to the earlier stages of the developmental cycle of the trypanosome by the method of feeding clean fleas on infected rats and examining them at definite periods subsequently. In this way we were led to the discovery that the development begins by the trypanosome penetrating into epithelial cells of the stomach, and there multiplying by fission in a peculiar manner. No similar stage has been observed hitherto in the life-cycle of any trypanosome, and this discovery may possibly throw light on some puzzling features of the development of pathogenic trypanosomes in tsetse flies; we have drawn the

attention of Miss Robertson to this stage, and I have had some correspondence with her about it; as she is now in Uganda working at the development of the trypanosome of sleeping sickness, I hope that our results may be a guide and help to her in her investigations. We have published a brief preliminary account of this phase in the " British Medical Journal " (No. 4 below). Our investigations upon this and other early stages of the development are now proceeding, and have not as yet reached a stage at which we can report fully upon them.

As soon as we have completed our investigations upon the early phases of the development of the trypanosome, and our experiments and observations upon the exact manner in which the trypanosome passes from the flea into the rat, our work on the developmental cycle of the parasite in the flea will be finished, and will be ripe for publication; I hope very much that in my next report I shall be able to give a complete account of the whole work. I thought we should have completed this research sooner than this, but we had no idea, when we began this investigation, how complicated and difficult it would turn out to be, and I fear that in my report of last year I was too sanguine. We hope to publish ultimately a complete monograph of the life-cycle of *Trypanosoma lewisi*, a thing which has not yet been done for any species of trypanosome; such a work, if we succeed in carrying out our intentions, would furnish, as it were, a standard example for the developmental cycle of these important parasites, and other species might be expected to differ from it in specific details, but to agree with it as regards the principal phases of the development. We do not wish, however, to bring out our final work until we have satisfied ourselves as to every stage we describe, and are able to bring forward full evidence in support of all our conclusions.

Collaboration with Dr. J. D. Thomson in the investigations on *Trypanosoma lewisi*, reported upon in the foregoing, has occupied most of the time which I have had free for research in the past year. In my previous report ([Cd. 5514], p. 27), I mentioned that in dissecting fleas I frequently found in them cysticercoids, which my colleague, Dr. Nicoll, of the Lister Institute, had identified as the larval stage of the common rat-tapeworm *Hymenolepis diminuta*. Since then I found in two fleas examples of a totally distinct cysticercoid, differing altogether in its characters from that previously found. Not being myself an expert helminthologist, I passed these specimens on to Dr. Nicoll, who investigated them further, and a joint paper on these parasites (No. 5 below) was communicated by us to the Zoological Society for publication.

Dr. Woodcock and myself have continued to collaborate in working out the material collected by us during our stay at Rovigno (*vide* [Cd. 4999], p. 47, and [Cd. 5514], p. 27). As Dr. Woodcock deals with this matter in his report appended below, I need not do so further, except to say that we have communicated a joint paper, now in the press, to the " Quarterly Journal of Microscopical Science " on the subject.

2. *Teaching and other work.*—In the months of January, February, and March of this year I gave a course of 24 lectures dealing with protozoa generally. The lectures were given on Mondays, Wednesdays, and Fridays, at 5 p.m., at the Lister Institute, and were followed by demonstrations of microscopic preparations illustrative of the subject of the lectures. The demonstrations were made by Dr. Woodcock and Miss Robertson under my supervision. The average attendance at the lectures was about 25, and included university students and assistant teachers, medical men, veterinary students, and other " naturæ curiosi." It is not for me to say so, but I am informed that the lectures were appreciated; at any rate, the attendance did not fall off.

In my last report ([Cd. 5514], p. 28), I mentioned that I was engaged in writing a manual of the protozoa. Since my course of lectures covered practically the same ground as my manual will do when completed, as soon as my lectures were finished I started to write up and complete my text-book; the work is now very nearly complete, and I hope to publish early in the new year (1912) at the latest.

I beg to report that the University of Breslau did me the honour of conferring upon me the degree of Doctor of Philosophy, *honoris causa*, at the centenary celebration of the university held on August 3rd of this year, although this does not come strictly within the period covered by this report.

A number of workers have occupied places in my laboratory during the past year, and have received assistance or instruction from me or my assistants.

Dr. J. D. Thomson has been collaborating with me in researches on *Trypanosoma lewisi*, as already stated.

Mr. J. S. Dunkerly has been working steadily in his leisure from official duties. He has been studying parasites of house-flies, and has published a memoir on the subject (No. 14 below); he also has a paper in the press on a new microsporidian parasite of the smaller house-fly, *Homalomyia canicularis*. In addition to these investigations he has been studying the flagellate fauna and the parasitic protozoa of Clare Island, as a collaborator in the survey of Clare Island, which is being carried out under the auspices of the Royal Irish Academy and the British Association. He also investigated an infectious disease of carp, &c., in a fishing lake at Norwood, by request, and found *Saprolegnia* to be the cause of the disease; foulness of the water had weakened the powers of resistance of the fish, and the gills were covered by the fungus-growth. Potassium permanganate, and afterwards cupric sulphate, were used; the water is now clear, and the fish healthy. Finally he examined, and is now reporting upon, the sewage sludge and effluent from Dibdin's State Sewage Beds, for Dr. McGowan, of the Royal Commission on Sewage.

Dr. W. Cecil Bosanquet has been working steadily throughout the year, chiefly on spirochætes. He has published a memoir in the " Quarterly Journal of Microscopical Science " (No. 12 below), and has also compiled and published a small treatise on this group of organisms (No. 13).

The following gentlemen or ladies have worked in the laboratory for the periods stated during the year covered by this report :—

Mr. T. Faithful Davies, M.R.C.V.S., attended my course of lectures and worked in the laboratory from January to May of this year at various parasitic protozoa, especially Sarcosporidia and other forms causing diseases in domestic animals.

In my last report ([Cd. 5514], p. 29), I mentioned that Major W. Glen Liston, I.M.S., had been engaged on investigations upon amœbæ causing dysentery and liver-abscess. Unfortunately, he was appointed last autumn to special duty in India, and was unable to go on with his investigations, which were beginning to lead to most promising results. He came here for a few days before starting for India, having written up a full report of the results he had obtained, and handed over his material to Mr. C. H. Martin, who completed the study of the preparations made by Major Liston. A joint memoir on this investigation was then communicated by Major Liston and Mr. Martin to the " Quarterly Journal of Microscopical Science "; it should have been out by this time, but the publication has been most unaccountably delayed.

Captain I. S. McKenzie, R.A.M.C., attended my course of lectures and worked in the laboratory from February till May, studying protozoa generally, and methods of technique more especially.

Mr. C. H. Martin, M.A., has worked in the laboratory at different times for short periods; his collaboration with Major Liston has been mentioned above; he has also collaborated with Miss Robertson in an investigation of the parasites of the common fowl; an instalment of their researches has been published (No. 11 below).

Miss Pixell, Demonstrator of Zoology at Bedford College, attended my course of lectures and worked in the laboratory at various parasitic protozoa; after searching without success for the Coccidian parasite of *Chiton* which has been described under the name *Minchinia chitonis*, she found some interesting Gregarines in a Serpulid, and has begun an investigation upon them.

Dr. R. Row, of Bombay, worked in the laboratory for a few weeks, studying the flagellate parasites of house-flies, and methods of technique in connection therewith.

Dr. Harald Seidelin attended my course of lectures and worked in the laboratory from December to February, chiefly upon problems of technique; he has published two memoirs (Nos. 15 and 16 below), part of the work for which was done here.

Mr. D. C. Wingate worked here from the beginning of May to the end of July, studying protozoa and technical methods generally.

Mr. R. B. Woosnam, on his appointment as Game Ranger in British East Africa, came here for about a fortnight to learn the technique of preserving and studying blood-parasites.

Finally, Mr. W. F. Lanchester and Mr. R. Kirkpatrick (of the British Museum of Natural History), have occupied places in the laboratory from time to time.

I have been in correspondence with the following gentlemen with regard to matters upon which they have sought my assistance or advice :—

Dr. John Rennie, of the Natural History Department, Aberdeen University, *re* trypanosomes in a blood-film from a native who died of sleeping sickness in Nyasaland, and films of spirochætes from North-Eastern Rhodesia.

Dr. W. B. Orme, Medical Officer, Larut, Perak, *re* technical methods of preserving and staining amœbæ, and *re* bodies in a blood-film from a patient suffering from tertian malaria.

Dr. R. E. Lloyd, Assistant Professor in the Medical College, Calcutta, *re* the peculiar parasitic genus of flagellates, *Lophomonas*.

Mr. A. E. Ordbrown, *re* various parasites occurring in frogs, domestic animals, &c., in Johannesburg.

Mr. D. J. Scourfield, F.R.M.S., *re* peculiar siliceous bodies, possibly skeletons of protozoa, in a geological formation.

Amongst preparations presented to the Department, I may mention especially a slide of *Schizotrypanum cruzi*, the human trypanosome of Brazil, presented by Dr J. H. Ashworth, of the University of Edinburgh, and preparations of an intestinal species of *Trypanoplasma*, and of *Amœba diploidea*, presented by Mr. C. H. Martin.

Appended will be found reports by my assistants, Dr. Woodcock and Miss Robertson, and a list of works published from this Department during the year covered by this report.

Report by H. M. Woodcock, D.Sc. Lond., Assistant to the University Professor of Protozoology, for the Year Ending June 30th, 1911.

My work during the past year has consisted of : (*a*) departmental work, and (*b*) research.

(*a*) A very considerable part of my time during the early months of this year—January to March—was occupied in assisting to prepare and arrange the exhibits for demonstration in connection with Professor Minchin's annual course of lectures. I have also given help as required to various workers in the laboratory.

(*b*) *Research.*—During the autumn I was working at the material collected at Rovigno in 1909, relating to the blood-parasites of the Little Owl, *Athene noctua* (*vide* [Cd. 4999], p. 47). This investigation has been carried out, in part, in collaboration with Professor Minchin, and certain results of our joint work, relating to the parasites as they are found in the bird, have been embodied in a paper which should appear very shortly in the "Quarterly Journal of Microscopical Science." These results, which are, we consider, of distinct importance, have reference chiefly to the trypanosomes (*T. noctuæ*); but incidentally certain facts with regard to the occurrence and behaviour of other intracorpuscular parasites of the same bird are also dealt with.

A summary of the main facts and conclusions of our paper is as follows :—

1. *Trypanosomes.*—All previous workers on the blood-parasites of the Little Owl have maintained that its trypanosomes comprise two entirely distinct and independent forms or species—a smaller, known as *Trypanosoma noctuæ*, and a larger, generally named *Trypanosoma* (or *Spirochœta*) *ziemanni*. *T. noctuæ*, according to Schaudinn and his adherents, was supposed to be simply the active phase in a life-cycle in which the *Halteridium* or *Hæmoproteus*, of the same bird represented a resting or intracorpuscular phase; while *T. ziemanni*, similarly, was supposed to be an alternating phase in the life-cycle of the *Leucocytozoon* occurring in the same host. In opposition to this view, we find that between these two forms of trypanosomes a regular series of transitional or intermediate forms occurs; a series transitional both in respect of size and also of other characters. In short, there is no doubt, in our opinion, that all the different types of form met with by us, which include those already described by other investigators, belong to one species of trypanosome—*T. noctuæ* (Schaudinn). This conclusion is perfectly in accord with the results of my previous work on another avian species of trypanosome—*T. fringillinarum* (*vide* No. 7 in list of published papers below).

A further point of interest brought out in our memoir is the occurrence in the summer months (May and June, and perhaps later summer months) of a distinct type of form which we did not find in the winter or early spring months This type of trypanosome is like a fairly small, stout spindle in form, which often appears leaf-like in permanent preparations as the result of flattening out. This type was the only form of the parasite which we found in the general circulation; it is certainly a transmissive phase, for it is capable of giving rise to characteristic developmental forms (which I have yet to describe) in the mosquito. We do not claim

that this is the only transmissive form existing; but we do consider that it represents a typical transmissive form of avian trypanosome, that is to say, the type by which the infection is transmitted from the vertebrate to the invertebrate (insect) host. I found a very similar condition during the summer in the case of the trypanosomes of the chaffinch, and I have no doubt that there also the stout spindle-form is essentially a transmissive phase. So far as I am aware, this marked tendency to a development of different phases at different periods of the year, observed in these two examples of avian trypanosomes, has not yet been pointed out in the case of any species of these parasites from other classes of vertebrate hosts.

The conclusion that we have formulated with regard to the specific unity of the different forms of trypanosome found in the Little Owl has an important bearing upon the much-debated question of an actual, ontogenetic connection between these " free " parasites and the intracorpuscular forms, *Halteridium* and *Leucocytozoon.* As pointed out above, these two forms of parasites have been supposed to be merely the resting phases of the small (*T. noctuæ*) and the large trypanosome (*T. ziemanni*), respectively. If this were so, it would follow from our observations on the trypanosomes that *Halteridium* and *Leucocytozoon* were also different forms or phases of one and the same parasite. This conclusion is manifestly impossible, since both *Halteridium* and *Leucocytozoon* have distinct and characteristic sexual processes, which prove decisively the complete independence of the two forms in question; hence we consider it practically certain that they cannot both be connected with the trypanosome of the Little Owl. As a matter of fact, we could not obtain the slightest indication that either of them had any such connection.

2. *Halteridium* and *Leucocytozoon.*—We paid particular attention to the examination of these parasites in the living condition, with a view to ascertaining whether either of them developed, at any period, an active, trypaniform phase, as maintained by Schaudinn. As regards *Leucocytozoon*, this parasite occurred nearly always in the condition of full-grown (ripe) or half-grown gametocytes, which had acquired the customary spindle-like appearance, and which showed distinct and easily-recognisable male or female characters, respectively. The only occasions on which these parasites were observed free from the corpuscle was when they had just ruptured the protoplasm of the host-cell (leucocyte), and had become rounded off, as passive female elements, or else had given rise to the active, thread-like male gametes. We had more than one opportunity of observing the latter, when alive, but we could not make out anything resembling an undulating membrane, or any other characteristic of a trypanosome; the male elements are distinctly larger than those of *Halteridium.*

In the owls infected with *Halteridium,* on the contrary, quite young forms of the parasites, as well as all transitions to mature gametocytes, were found, usually without much difficulty, in the blood. In those birds in which the *Halteridium* was numerous or abundant, parasites were seen in the living cover-slip preparations (as well as subsequently in the permanent preparations), which were often quite free from a blood corpuscle, although they were not rounded-off or producing male gametes. In one case, an abundant infection, these free forms varied considerably in size, from small individuals up to forms half-grown, or larger. So far as could be seen the free forms appeared to be perfectly similar to those contained in the corpuscles, both when studied in the living state or in permanent-stained preparations. It is important to note that the free forms were quite motionless, and though particular individuals were watched for a considerable period, they were not observed to undergo any change. In spite of much searching, none of the parasites were caught in the act of being liberated from the corpuscles; it is certain, however, that most, or all, of the free individuals had been parasitic within a red corpuscle, since the majority of them contain the grains of melanin-pigment produced by the destruction of the hæmoglobin of the corpuscle. We have discussed in our paper the manner in which this liberation of certain individual parasites is caused; we do not believe it to be artificial (*i.e.*, due to manipulation in making the preparation), and I need only say here that we think it is a purely passive process, so far as the parasite is concerned.

I have laid stress on the occurrence of motionless, unaltered " free " *Halteridia* (which was briefly mentioned in a former report, written direct from Rovigno, *vide* [Cd. 4999], p. 54), because, taken in conjunction with the results obtained by our detailed study of the trypanosomes of the Little Owl, it is, we think, strong evidence against Schaudinn's conclusion that the Halteridia are resting stages of the trypanosome. It is true that all our evidence is negative; we can only say, however, that if

transformation of one of these intracorpuscular parasites into a trypanosome, or *vice versâ*, really does occur, we ought to have seen some evidence of the fact, since we were able to study many more infected owls than was Schaudinn.

Since our paper was finished, and sent for publication (in April last), I have been engaged partly in working out the mosquito material that I brought back from Rovigno, with a view to ascertaining what developmental forms of the parasite are found in the mosquito. I am somewhat uncertain, at present, whether this insect is the true alternate host for any of the other protozoan blood-parasites of birds besides trypanosomes and the *Proteosoma*-parasite of bird-malaria; there are grounds for believing that the mosquito is not the proper host for either *Halteridium or Leucocytozoon.* I am, therefore, at the same time continuing my work on the blood-parasites of the chaffinch, in the endeavour to settle the question in their case.

Quite recently I have observed an interesting and peculiar condition in *Halteridium fringillæ*, which must be very unusual, for this is the first occasion on which I have seen it, notwithstanding a very good acquaintance with this parasite. In one infected bird, many of the parasites, both half-grown and full-sized forms, were found in stained preparations to have the nucleus double. By this I do not mean merely that they showed the so-called binucleate condition, with two differentiated nuclei, but that the large principal nucleus is double. Some individuals show the smaller nuclear element in addition, and in such cases this also is double. In the half-grown parasites the body appears single, and, so far as the cytoplasm is concerned, there is not the least indication that two individuals are present; in some of the large forms, however, the cytoplasm shows a split, running more or less longitudinally through the middle of the body. This split is either complete or incomplete; in the former case the appearance is presented of two individuals, each with a single principal nucleus, which usually lie parallel to one another on the same side of the blood-corpuscle, between its nucleus and the longest side, in the customary position of the parasite.

On first studying this condition I thought the most likely explanation was that it represented different stages in the binary fission of a single individual. But after considerable examination of my slides I have come to the conclusion that this cannot be the correct explanation in all cases, at any rate, for one or two examples show one nucleus to be distinctly male in character, the other female, although the body is quite single, and there is no indication of a cytoplasmic split. In such a case there must obviously be two individuals present, which have undergone cytoplasmic fusion; and the same explanation may apply throughout, though I do not feel quite certain that it does. If my interpretation be correct, this condition represents the complete, though temporary, cytoplasmic fusion of two individuals, which later separate again, rather than the fission of a single individual.

Hitherto, whenever I have seen a corpuscle infected by two parasites, they have been situated always either on opposite sides of the nucleus, or near opposite ends of the corpuscle. In the bird which is the subject of these remarks, the infection is not a very heavy or abundant one, comparatively speaking, and I have noticed in it only two or three instances of corpuscles doubly infected in the ordinary way, while on the other hand these peculiar " double individuals " are fairly numerous. If the true explanation is that which I have suggested, it is rather remarkable that two halteridial parasites, entering the same corpuscle, should undergo cytoplasmic union while quite young, and when there is plenty of room in the cell for their separate development, and should further assume the same form and grow in the same manner as an ordinary single gametocyte. So far as I am aware, this interesting peculiarity has not been observed before in *Halteridium*, hence I think it is worth while putting my observations of this condition on record, and I have communicated a brief note upon it, illustrated with text-figures, to the " Zoologischer Anzeiger."

H. M. Woodcock.

Report of Miss Muriel Robertson, M.A., Assistant to the University Professor of Protozoology, for the Ten Months Ending April 30th, 1911.

I. Research.

During the past year the work on the life-cycle of *Hæmogregarina nicoriæ*, the hæmogregarine inhabiting the blood of the common lake tortoise of Ceylon, which

was mentioned in my last report (*vide* [Cd. 5514], p. 33), has been completed and published (No. 9 in the list of publications given below).

The greater part of the summer and autumn of 1910 was devoted to research upon the transmission of trypanosomes parasitic in the blood of freshwater fishes. I was relieved of my routine duties at Chelsea and spent six months in the laboratories of the Lister Institute at Elstree.

In the garden of the Institute at Elstree is a pond which had been stocked with goldfish for a considerable number of years. In 1905 Dr. Petrie found the fish to be almost invariably infected with a species of trypanosome, probably *Trypanosoma danilewskyi* of the carp. In 1908 Dr. Thomson found the fish still infected, and was able to cultivate the organism upon blood-agar. In June, 1910, when I went out to Elstree, a trypanoplasm had appeared in the blood of many of the fish in addition to the trypanosome noted by the two earlier workers. This trypanoplasm is almost certainly to be considered as a new arrival in the pond, as it is very unlikely that it should have been over-looked by Dr. Petrie and Dr. Thomson. Clean (*i.e.*, non-infected) goldfish were obtained by the kindness of Mr. T. H. Riches from an artificial pond in his garden at Shenley, distant about three miles from Elstree. These fish had been investigated at intervals for several years by Mr. T. H. Riches, Professor Minchin, and Dr. Thomson, and had always proved to be non-infected.

The pond in the garden was carefully searched for the intermediate or transmitting host, and a small species of leech, *Hemiclepsis marginata*, was found. Some of the leeches were placed on clean fish and produced typical infections with trypanosomes and trypanoplasms. Towards the end of July I found numerous leeches of this species in the reservoir of the Grand Junction Canal at Elstree, which is distant only about a quarter of a mile from the pond in the garden of the Institute. Many of these leeches were carrying eggs or young broods with them. The young leeches were isolated, each brood by itself, and some of them were taken and fed on clean fish, as controls. It was found that young leeches fed on clean fish never developed either trypanosomes or trypanoplasms in their digestive tract—a result which bears out the exactly similar experimental results obtained by Brumpt, who was working with the same species of leech.

A number of experiments were then undertaken which would take too long to describe in full, but the results and conclusions from them may be summarised as follows :—

(1) In *Hemiclepsis marginata* trypanosomes and trypanoplasms are not transmitted from parent to offspring.

(2) The trypanosomes of the goldfish, perch, bream, rudd, and pike, can all complete their developmental cycle in *Hemiclepsis marginata*.

(3) The following passages of trypanosomes from infected to clean fish were effected by means of artificially-infected leeches hatched in the laboratory : goldfish to goldfish; perch to goldfish; bream to goldfish.

(4) The developmental cycles of the different species of trypanosomes in the leech appear to be quite similar, and to run the following course : The blood of the fish containing the trypanosomes is sucked up by the leech into its crop. The trypanosomes soon change their shape, becoming broader and shorter and often spirally twisted. In about 6-9 hours they divide by budding off a small individual from the posterior end of the body; the young individual produced is not trypaniform in its characters, but is a small pear-shaped organism with a single flagellum and has as yet no undulating membrane, the kinetonucleus lying anterior to the trophonucleus. Division of both parent and young form succeeds at intervals of about 6-9 hours until, in about 48-72 hours from the beginning the whole crop is peopled with vast numbers of flagellates mostly in the crithidial state. (The word " crithidial " is used here simply as a convenient descriptive term for the developmental stages of a trypanosome in which the kinetonucleus is in front of the trophonucleus.) As time goes on, the majority of the flagellates become trypaniform in their characters, but still vary greatly in size, being mostly rather broad, and division still proceeds actively. Soon the trypanosomes lengthen out, and a long slender type is developed, quite different from anything seen so far in the developmental cycle. The slender forms are produced quite gradually from the broader forms. They migrate forwards at the end of digestion and lie in the

proboscis-sheath in great numbers. They are very uniform in size and appearance and form quite a definite type, which was never observed to undergo division. They lie in the proboscis-sheath, where they can readily be seen through the body-wall in young transparent leeches, and are injected into the next fish upon which the leech feeds.

The cycle of the trypanosome in the leech corresponds in length to the time taken by the leech to digest one meal of blood. As the leech increases in sizes, the cycle lengthens.

(5) A slight rise in the temperature of the surroundings of the leech (for example, up to 22° C. in an incubator) during the active period of digestion will prevent the trypanosomes from developing. This is probably due to the leech being able to digest the trypanosome at this temperature. The trypanosomes are not affected when an infected leech is placed in the incubator after the active period of digestion is passed (*i.e.*, when the red blood has broken down and disappeared).

(6) The trypanosome in the newly-drawn blood of the fish can be induced to divide in exactly the same way and at just the same intervals as in the crop of the leech by lowering the osmotic pressure of the blood by the admixture of water. On the other hand, isotonic or slightly hypertonic solutions of various salts do not produce division when mixed with the blood.

The work summarised above has been completed and published in the Philosophical Transactions of the Royal Society (No. 10 of the list of papers below).

In addition to the foregoing, I have completed a short paper supplementing the work done last year by Professor Minchin and myself on the division of the collar-cells of sponges (*vide* [Cd. 5514], pp. 27 and 34). This paper has been left in manuscript with Professor Minchin, who has kindly undertaken to see it through the press.

II. Official Work.

The rest of my work during the past year has comprised the usual routine of the laboratory, assisting in the demonstrations and giving informal assistance to the workers in the laboratory. During July of last year I undertook the preparation of the demonstration of parasitic Protozoa for the Museum of the British Medical Association, which met in London. This exhibit comprised about 50 microscopic specimens selected and arranged so as to illustrate the life-cycles of the more important parasitic Protozoa, and naturally involved a considerable amount of time and labour.

MURIEL ROBERTSON.

LIST OF WORKS PUBLISHED FROM THE UNIVERSITY DEPARTMENT OF PROTOZOOLOGY DURING THE YEAR ENDING JUNE 30TH, 1911.

By Professor E. A. Minchin :—

(1) [Remarks on the Nature of the Living Substance.]
Proceedings of the Linnean Society of London, 122nd Session, pp. 79-83. (*Vide* [Cd. 5514], p. 28.)

(2) Some Problems of Evolution in the Simplest Forms of Life. (Presidential Address.)
Journal of the Quekett Microscopical Club, series 2, Vol. XI., pp. 165-180.

(With Dr. J. D. Thomson.)

(3) The Transmission of *Trypanosoma lewisi* by the Rat-flea (*Ceratophyllus fasciatus*).
British Medical Journal, 1911, Vol. I., pp. 1,309, 1,310.

(4) On the Occurrence of an Intracellular Stage in the Development of *Trypanosoma lewisi* in the Rat-flea.
Ibid., 1911, Vol. II., pp. 361-364.

(With Dr. W. Nicoll.)

(5) Two Species of Cysticercoids from the Rat-flea (*Ceratophyllus fasciatus*).
Proceedings of the Zoological Society of London, 1910, pp. 9-13, 2 text-figg.

(With Miss Muriel Robertson.)

(6) The Division of the Collar-cells of *Clathrina coriacea* (Montagu); a Contribution to the Theory of the Centrosome and Blepharoplast.
Quarterly Journal of Microscopical Science, Vol. LV., pp. 611-640, pls. xxv., xxvi. (*Vide* [Cd. 5514], p. 27.)

By Dr. H. M. Woodcock :—

(7) Studies on Avian Hæmoprotozoa. I. On Certain Parasites of the Chaffinch (*Fringilla coelebs*) and the Redpoll (*Linota rufescens*).
Ibid. (*T. c.*), pp. 641-740, pls. xxvii-xxxi.

(8) Protozoa.
Zoological Record, Vol. XLVI., 1909, 61 pp.

By Miss Muriel Robertson :—

(9) Studies on Ceylon Hæmatozoa. II. Notes on the Life-cycle of *Hæmogregarina nicoriæ*, Cast. & Willey.
Quarterly Journal of Microscopical Science, Vol. LV., pp. 741-762, pls. xxxii-xli., 1 text-fig.

(10) Transmission of Flagellates living in the Blood of certain Freshwater Fishes.
Philosophical Transactions of the Royal Society, Series B, Vol. CCII., pp. 29-50, pls. i., ii., 4 text-figg.
(*Vide etiam* No. 6.)

(With Mr. C. H. Martin.)

(11) Further Observations on the Cæcal Parasites of Fowls, with some Reference to the Rectal Fauna of other Vertebrates. Part I.
Quarterly Journal of Microscopical Science, Vol. LVII., pp. 53-81, pls. x-xiv., 4 text-figg.

By Dr. W. Cecil Bosanquet :—

(12) Brief Notes on the Structure and Development of *Spirochæta anodontæ*, Keysselitz.
Quarterly Journal of Microscopical Science, Vol. LVI., pp. 387-393, pl. xv.

(13) Spirochætes; a Review of Recent Work with some Original Observations.
W. B. Saunders Company (*London and Philadelphia*), 1911, *illustrated.*

By Mr. J. S. Dunkerly :—

(14) On some Stages in the Life-History of *Leptomonas muscæ-domesticæ*, with some Remarks on the Relationships of the Flagellate Parasites of Insects.
Quarterly Journal of Microscopical Science, Vol. LVI., pp. 645-655, pl. xxxi.

By Dr. H. Seidelin :—

(15) Protozoon-like Bodies in the Blood and Organs of Yellow-Fever Patients.
Journal of Pathology and Bacteriology, Vol. XV., pp. 282-288, pls. xxix., xxx.

(16) An Iron-Hæmatein Stain.
Parasitology, Vol. IV., pp. 94-103, pl. v.

APPENDIX III.

Report on the Work of the Quick Laboratory, Cambridge, dated 17th November, 1911.

A list of papers published by the workers in the Quick Laboratory since my last Report appeared is herewith appended. The list indicates that the investigations carried on in the Laboratory relate mainly to protozoal diseases and to the Arthropods which transmit them.

The following workers have been engaged continuously in research in the laboratory:—Mr. C. Warburton, M.A. (appointed November, 1911, to be Demonstrator in Medical Entomology); Mr. C. Strickland, M.A., B.C. (Assistant to the Quick Professor); Mr. G. Merriman (Trinity Hall, Student in Medical Entomology); E. Hindle, Ph.D. (Beit Memorial Fellow for Medical Research).

Miss Annie Porter, D.Sc. (London), has worked in the Laboratory, on and off, during the year. Major C. E. Williams, M.D., I.M.S. (Sanitary Commissioner for Burma), and Mr. K. P. Williamson, M.A. (Indian Educational Service), worked in the Laboratory during several months. Dr. G. Beatty (Medical Officer, Southern Nigeria), came to us, at the instance of the Colonial Office, for special instruction. Mr. R. C. Lewis, M.A. (Cape of Good Hope), and Miss Jordan Lloyd (Newnham College), have joined the Laboratory this term with the object of carrying on research work in parasitology.

My own work, apart from an extensive interchange of material and correspondence with workers in the tropics, and the details of directing the work of the Laboratory, has been in relation to:—(1) East Coast fever in cattle, including studies upon the parasite and experiments bearing upon the curative treatment of the disease (still in progress); (2) biliary fever in horses, wherein, with the aid of Mr. Strickland, it has been shown that two distinct diseases, due to distinct parasites, have hitherto been confused under this name; (3) redwater in cattle; (4) piroplasmosis in dogs (immunity); (5) raising experiments upon various species of pathogenic ticks; (6) superintending operations in connection with the Suffolk rat-flea investigations on behalf of the Local Government Board; (7) systematic work on ticks, and studies upon their biology.

The systematic work on ticks has entailed much labour on the part of Mr. Warburton and myself, who have recently published Part II. of our Monograph on Ticks. Both Mr. Warburton and myself have described species of ticks which are new to science, and have had to handle a vast number of specimens which were referred to us by the Entomological Committee (Tropical Africa) for determination and study. Mr. Strickland has worked upon the biology of rat-fleas and the parasites they contain, including *Trypanosoma lewisi.* Messrs Strickland and Merriman have been busily engaged during a period of 18 weeks in connection with the rat-flea inquiry in Suffolk, carried out at the instance of the Local Government Board, Mr. Merriman being uninterruptedly engaged in field work during that period. The results of these investigations will shortly be reported upon. Mr. Merriman has continued his studies upon the biology of *Ornithodorus moubata*, and has published a paper on its geographical distribution; he has also devoted much time and patient labour to ordering the collections of blood-sucking insects which have reached us from all parts of the world.

The mode of transmission of *Spirochaeta duttoni* by *Ornithodorus moubata* has been a subject of investigation on the part of Dr. Hindle, who has also carried out experiments upon the passage of *Trypanosoma lewisi* through cold-blooded animals, thereby increasing their virulence. He has made therapeutical experiments with various drugs in relation to Trypanosomiasis in animals, and is at present engaged in studying *Spirochaeta marchouxi* (*gallinarum*) and its life-history in *Argas persicus.* During the long vacation he worked, with great profit to himself, at the Institut Pasteur, Paris.

The grant allowed by the Tropical Diseases Research Fund Committee to the Quick Laboratory in the past has been of immense help in furthering our work. I trust, therefore, that the Committee may see its way to continue and slightly increase the amount of the grant, especially in view of the increased expenditure which is required to meet the growing demands upon the Laboratory.

GEORGE H. F. NUTTALL.

List of Publications for the Year 1911

1. Nuttall, G. H. F., and Strickland, C. (XII., 1910). Die Parasiten der Pferde piroplasmose resp. der "Biliary Fever." *Centralbl. f. Bakt.*, &c. I. Abt. Originale., LVI., 524-525.
2. Warburton, C. (XII., 1910). On two Collections of Indian Ticks. "*Parasitology*," III., 395-407, 10 text-figures.
3. Nuttall, G. H. F. (XII., 1910). New Species of Ticks (*Ixodes*, *Amblyomma*, *Rhipicephalus*). "*Parasitology*," III., 408-416, 7 text-figures.
4. Hindle, E. (XII., 1910). Degeneration Phenomena of *Trypanosoma gambiense*. "*Parasitology*," III., 423-435, Plate XXX.
5. Strickland, C., and Swellengrebel, N. H. (XII., 1910). Notes on *Trypanosoma lewisi* and its relation to certain *Arthropoda*. "*Parasitology*," III., 436-454, 1 text-figure.
6. Hindle, E. (XII., 1910). A Biometric Study of *Trypanosoma gambiense*. "*Parasitology*," III., 455-458.
7. Swellengrebel, N. H. (XII., 1910). Normal and Abnormal Morphology of *Trypanosoma lewisi* in the blood of the Rat. "*Parasitology*," III., 459-478, 15 diagrams.
8. Howlett, F. M. (XII., 1910). The Influence of Temperature upon the biting of Mosquitoes. "*Parasitology*," III., 479-484, 4 text-figures.
9. Howlett, F. M. (XII., 1910). On the Collection and Preservation of Insects. "*Parasitology*," III., 485-489, 3 text-figures.
10. Porter, A. (III., 1911). Some remarks on the genera *Crithidia*, *Herpetomonas*, and *Trypanosoma*. "*Parasitology*," IV., 22-23.
11. Hindle, E. (III., 1911). The passage of *Trypanosoma gambiense* through mucous membranes and skin. "*Parasitology*," IV., 24-27.
12. Nuttall, G. H. F., and Merriman, G. (III., 1911). The process of copulation in *Ornithodorus moubata*. "*Parasitology*," IV., 39-45, 1 text-figure.
13. Nuttall, G. H. F. (III., 1911). On the adaptation of ticks to the habits of their hosts. "*Parasitology*," IV., 46-67, 26 text-figures.
14. Nuttall, G. H. F. (VI., 1911). On symptoms following tick-bites in man. "*Parasitology*," IV., 89-93.
15. Swellengrebel, N. H., and Strickland, C. (VI., 1911). Some remarks on Dr. Swingle's paper, "The transmission of *Trypanosoma lewisi*, by rat-fleas, &c." "*Parasitology*," IV., 104-107.
16. Hindle, E. (VI., 1911). The transmission of *Spirochaeta duttoni*. "*Parasitology*," IV., 133-149.
17. Porter, A. (VI., 1911). Further remarks on the genera *Crithidia*, *Herpetomonas* and *Trypanosoma*, and Dr. Woodcock's views thereon.
18. Merriman, G. (VI., 1911). The Geographical Distribution of *Ornithodorus moubata* (Murray, 1877). "*Parasitology*," IV., 168-173, 1 Map.
19. Nuttall, G. H. F., and Warburton, C. (VII., 1911). Ticks. A Monograph of the Ixodoidea. Part II. The *Ixodidae*., xx.—244 pp., with 206 figures (14 in 4 plates), 98 being original. Cambridge University Press.
20. Nuttall, G. H. F., Robinson, L. E., and Cooper, W. F. (VII., 1911). Bibliography of the *Ixodoidea*. (2,004 titles of publications dealing with ticks and their relation to disease). Cambridge University Press.
21. Nuttall, G. H. F. (X., 1911). Notes on Ticks, I. (1) *Ixodes caledonicus* description of Male, together with Considerations Regarding the Structure of the Foot in Male *Ixodes*. (2) Types of Parasitism in Ticks, illustrated by a Diagram, together with some remarks upon Longevity in Ticks. (3) Regarding the Loss of Life in Ticks occurring on Wandering Hosts. "*Parasitology*," IV., 175-182, 2 text-figures.
22. Hindle, E. (X., 1911). The Relapsing Fever of Tropical Africa : A Review. "*Parasitology*," IV., 183-203, 2 Maps and 1 Chart.
23. Strickland, C. (X., 1911). Description of a *Herpetomonas* parasitic in the Alimentary Tract of the Common Green-bottle Fly, *Lucilia* sp. "*Parasitology*," IV., 222-236, Plates VIII. and IX., 2 text-figures.
24. Porter, A. (X., 1911). The Structure and Life History of *Crithidia pulicis* n. sp., Parasitic in the Alimentary Tract of the Human Flea, *Pulex irritans*. "*Parasitology*," IV., 237-254, Plate X.

APPENDIX IV.

Reports from London School of Tropical Medicine.

No. 1.

The LONDON SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 17 May, 1911.)

Seamen's Hospital Society, Dreadnought Hospital,
Greenwich, S.E., 15th May, 1911.

Sir,

Enclosed I have the honour to submit the half-yearly reports of the Entomologist, Helminthologist, and Protozoologist at the London School of Tropical Medicine.

I am, &c.,
P. MICHELLI,
Secretary.

Enclosure 1 in No. 1.

London School of Tropical Medicine.

Report of the Entomologist of the London School of Tropical Medicine for the half-year ending 30th April, 1911.

During the half-year ending 30th April, which covers two Sessions of the School, I have given two ordinary courses of lectures and demonstrations on arthropoda and venomous snakes, taken from the medical standpoint. I have also given two courses of special tuition—one on medical zoology in general, and the other on entomology.

Miss Sophia Summers, M.A., B.Sc., one of the Carnegie scholars of the Aberdeen University, has also received special instruction from me, and has continued to work under my direction during the whole period under report. As a result she has published, or prepared for publication, two short papers—one on a new species of *Tabanidæ* from South America, the other on a new species of *Simulium* from Siam. The " types " of these new species have been presented to the British Museum.

Many additions have been made both to the Museum and to the teaching collection of prepared specimens. The following is a summary of acquisitions, arranged according to their geographical sources :—

(a) *Africa.*

Dr. H. E. Arbuckle.—Flies from Sierra Leone.

Dr. D. Burrows.—A particularly fine specimen of *Naja melanoleuca,* from Sierra Leone.

Dr. G. Carpenter.—Specimens of *Simulium damnosum, Glossina palpalis,* and *Tabanidæ,* from Uganda.

Dr. H. A. Foy.—A collection of insects, from Northern Nigeria.

Dr. George M. Gray.—A collection of snakes, from Southern Nigeria.

Prof. R. T. Hewlett.—Specimens of *Hemimerus talpoides,* from West Africa.

Dr. J. A. Hanley.—Some mosquitoes and other blood-sucking flies, from Gambia.

Dr. R. Van Someren.—Numerous specimens of *Glossina palpalis* and pupæ, from Uganda.

Dr. H. F. Standing (through Sir Patrick Manson).—A large collection of noxious insects and ticks, from Madagascar.

(b) *America.*

Capt. J. F. Siler, Medical Corps, U.S. Army.—A fine specimen of *Crotalus horridus,* from North America.

Dr. C. L. Eyles.—Numerous mosquitoes and flies, including many larvæ of *Stegomyia fasciata* and *Culex fatigans,* from British Honduras.

Prof. R. T. Hewlett.—A specimen of *Lachesis nummifer*, from South America.

Dr. J. H. Hughes Harris.—A collection of noxious insects, from British Honduras.

(*c*) *Asia.*

Dr. H. Bryan.—A specimen of *Lachesis*, from Hainan.

Major Chamberlain, Medical Corps, U.S. Army.—A specimen of *Dryophis mycterizans*, from the Philippines.

Capt. A. B. Fry, I.M.S.—A choice selection of Indian mosquitoes.

Dr. W. Woolliscroft.—Several consignments of noxious insects and venomous snakes, including a fine specimen of *Vipera Russellii*, from South India.

Dr. A. G. Carment.—Flies and snakes, from Pahang.

Dr. A. Kerr.—A selection of mosquitoes and other blood-sucking flies, from Siam.

(*d*) *Australia.*

Dr. C. L. Strangman.—A large collection of snakes, from Port Darwin, including several notoriously venomous species.

(*e*) *Europe.*

Dr. H. Bayon.—Several consignments of fleas and lice, from Moscow.

Dr. A. Hutton.—Several consignments of aquatic insect-larvæ of great importance, from England and Scotland.

Prof. E. A. Minchin, F.R.S.—Larvæ of *Ceratophyllus fasciatus*, from British rats.

H. J. Morton, Esq.—Larvæ of *Mochlonyx* and adults and larvæ of *Anopheles* and *Culex*, from Bournemouth.

Information has been furnished to numerous correspondents.

Considerable progress has been made with a Manual of Entomology for medical officers.

A. Alcock,
Lieut.-Col., I.M.S. (Retired List).

Enclosure 2 in No. 1.

London School of Tropical Medicine.

Report of the Helminthologist for the half-year ending 30th April, 1911.

Sir,

I have the honour to submit my report for the half-year ending May 1st, 1911, and to forward copies of publications made during the period.

My time has been employed wholly in teaching and in research in the special subject for which I hold my appointment.

Teaching.—(*a*) The ordinary classes which form part of the School "certificate" curriculum in tropical medicine were held in December and March.

(*b*) The course of practical instruction in veterinary helminthology for qualified veterinary surgeons was held in November and extended over a period of three and a half weeks.

(*c*) "Lectures to nurses on tropical subjects" were again given to those nurses in training for the Colonial Service at the Seamen's Hospital.

Research workers.—Dr G. M. Gray, W.A.M.S., of Lagos, brought some tumours for confirmatory diagnosis, and wrote the paper enclosed.

Dr. A. Hutton, of the West African Medical Staff, again occupied a table in the Research Laboratory for several weeks, and has written a paper on *Passalurus ambiguus*, which will be published shortly.

Major A. C. Lane, of the Indian Medical Service, spent three months' study leave in the laboratory, and personally made himself acquainted with a large number of the parasites of domesticated animals, paying special attention to those known to occur in India.

Reports, etc.—A considerable quantity of material has again been received from collectors in various parts of the world for examination. The specimens in every case were examined on arrival, and preliminary reports returned to the senders.

I have also submitted reports, by request, as under :—

(*a*) To the Local Government Board on the subject of *Onchocerciasis* in Australian meat. This report, a copy of which is appended, was afterwards published in full, as one of the official reports of the Board. It has been reprinted verbatim by " The Veterinary News " and " The Journal of Tropical Medicine," and has received editorial comment in " The British Medical Journal " and " The Lancet." After the publication of the report further information was submitted, by request of the High Commissioner for the Commonwealth of Australia and the Agent-General for Queensland.

(*b*) An arrangement was entered into with the Prosectorial Committee of the Zoological Society, whereby I have undertaken to examine and submit monthly reports upon the nematode parasites collected in the Zoological Gardens.

(*c*) My Report to the Grouse Disease Committee of Inquiry (Board of Agriculture) has been completed, and is now passing through the Press.

Original investigations.—The following papers, which have been published during the latter half of the period under review, indicate the character of the research work that has occupied my attention, in addition to that incorporated in the above reports :—

(1) Note on the presence of a lateral spine in the eggs of *Schistosomum japonicum.*
" Transactions of the Society of Tropical Medicine and Hygiene."

(2) Note on native tradition.
" Journal of Tropical Medicine and Hygiene," April 1st, 1911.

(3) Remarkable case of scrotal infection with *Filaria loa.*
" Journal of Tropical Medicine and Hygiene," April, 1911.

(4) *Oesophagostomum apiostomum* as an intestinal infection of man in Nigeria.
" Journal of Tropical Medicine and Hygiene," April 1st, 1911.

(5) Some new nematode parasites from Tropical Africa.
" Zoological Society Proceedings," April 25th, 1911.

(6) Note on Kwan's fluke and the presence of spines in *Fasciolopsis.*
" Journal of Tropical Medicine and Hygiene," April 15th, 1911.

(7) Variations in the eggs of *Schistosomum hæmatobium.*
" Journal of Tropical Medicine," April 15th, 1911.

(8) Seasonal incidence of guinea worm on the Gold Coast.
" Journal of Tropical Medicine and Hygiene," May 1st, 1911.

(9) An account of nematode parasites collected in the Zoological Gardens during the year ending November, 1910.
" Abstract in Proceedings of the Zoological Society," April 4th, 1911.

In addition to the above, a considerable amount of work has been done in preparation for papers (*a*) upon a small collection of parasites sent by Colonel Sir David Bruce from the Sleeping Sickness Commission; (*b*) some new parasites from Tropical Africa for the " Revue Zoologique Africaine "; (*c*) helminthes from the Sudan for the forthcoming report of the Khartoum College; (*d*) a small collection of parasites from Nyasaland forwarded by the Editor of " Parasitology." The accounts of these collections will probably be published during the next half-year.

Bibliographical work.—With the assistance of a grant from the Advisory Board, I have been able to resume the bibliographical work which had been put aside for some little time owing to the pressure of other work. In January Miss Maher was appointed, and some progress has already been made. A detailed account of the work will be submitted with the yearly report on November 1st.

I have, &c.,
ROBERT THOMSON LEIPER.

Enclosure 3 in No. 1.

LONDON SCHOOL OF TROPICAL MEDICINE.

REPORT of Protozoologist for six months ending 30th April, 1911.

In my last report I gave an account of the work done by the expedition sent out to investigate the nature of the Oriental Sore. The progress of the work was

very much handicapped by the unfortunate accident which resulted in the death of my assistant and the loss of much material. Work was resumed by me single-handed, but was again upset by the outbreak of cholera which prevented the carrying out of a scheme for the investigation into the possible relation of the sand-fly (*Phlebotamus*) to the disease. When it was possible to continue the work the season was so far advanced that *Phlebotamus* could not be secured, so that this section of the work remains incomplete.

An experiment conducted by me to determine the infectivity or otherwise of *Stegomyia fasciata*, the mosquito in which the button parasites develop into flagellate forms, has given only a negative result. I am therefore unable to give any proof that the *Stegomyia fasciata* may act as a transmitter of the disease.

As regards the incubation period of the disease, I am able to state definitely that this is about two months. A European was inoculated by me in the fore-arm with fluid squeezed from a button. The method of inoculation was by scarification, as in ordinary vaccination against smallpox. The wound caused by the operation healed, and after a period of two months there developed at the spot a small papule, which turned out to be a typical button. At the same time there appeared two other small buttons on the other arm. The first mentioned button appeared at the exact spot of inoculation, so there can be no doubt that this was produced in the manner indicated. As regards the two buttons on the other arm, one must suppose that they were natural infections acquired in the usual manner, the more probable explanation, or that a single inoculation is liable to produce buttons at spots far removed from the point of infection. The constant appearance of the buttons on the exposed surface only is strong argument against the latter view, for if a single inoculation was able to produce buttons at points other than that chosen for the inoculation, then one would expect to find buttons on the unexposed surfaces of the body more frequently.

The details of the investigations on the Oriental Sore will shortly be published in an illustrated report along with certain observations I have made in Bagdad on the gregarine of *Stegomyia fasciata*, first described by Ross, and on the hæmogregarine which is to be found in the leucocytes of the dog's blood. In the case of the hæmogregarine I have studied some of the stages of development which occur in the body of the tick *Rhipicephalus saguineus* and which were first noted by Christophers in India.

I am hoping during the coming summer to extend these observations.

I left Bagdad on November 12th, and arrived in England on January 1st. My journey home was much delayed by the repeated quarantines imposed by the Turkish Government against the various cholera-stricken districts.

Since my return I have been occupied in working up the material brought home, in making drawings of the various stages of the parasites, and in preparing my detailed report, which will shortly be published.

During the past session I have also been occupied with the usual teaching in the protozoological section of the general course.

C. M. Wenyon.

No. 2.

LONDON SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received November 17, 1911.)

London School of Tropical Medicine (University of London),
Greenwich, S.E., 16th November, 1911.

Sir,

Enclosed I have the honour to send you the half-yearly reports of the Special Departments in Entomology, Helminthology, and Protozoology, at the London School of Tropical Medicine. To these are added two papers* published by Colonel A. Alcock, various publications* by Dr. R. T. Leiper, and a report* on Oriental Sore in Bagdad by Dr. C. M. Wenyon.

The number of students attending the school continues to increase and 64 have entered for the present session. The accommodation in the general laboratories is now

* Not reprinted.

fully occupied. Residence for students is below the demand and many who desire to live within the precincts of the School have to seek accommodation elsewhere.

The total number of students for the year is 159. These may be classified as follows:—

Colonial Service	66
Indian Medical Service	12
Government of India	2
Government of Java...	1
Government of the Transvaal	1
Missionaries	21
Private Students	56
Total	159

The Royal Colleges of Physicians and Surgeons now grant a diploma in the diseases and hygiene of the tropics. Dr. J. Bruce Bays, a student of the London School of Tropical Medicine, is the first to have obtained this diploma.

Nine students have obtained the Cambridge Diploma in Tropical Medicine and Hygiene during the year.

The newly constructed laboratories for helminthology and protozoology were opened this session. They are erected at the south-west angle of the School and comprise a laboratory for the head of each department, laboratories for special and advanced students, together with incubating rooms, assistants' rooms, &c. There is now accommodation in the special departments for 20 students.

I am, &c.,
P. MICHELLI,
Secretary.

Enclosure 1 in No. 2.

REPORT of the ENTOMOLOGIST for the half year ending 31st October, 1911.

I have the honour to submit the customary report on the work of my department for the half year ending 31st October, 1911.

During the summer session I gave the usual course on entomology, which included lectures, and a series of practical demonstrations of specimens handled and dissected by the students. I also conducted a special course for medical and other officers deputed by the Colonial Office. This course, which comprised 15 meetings, each of about 2½ hours, was attended by 14 officers. I also gave the usual course on venomous snakes and snake-venoms.

Miss Sophia L. M. Summers, Carnegie scholar of the University of Aberdeen, worked in my laboratory and under my direction during the session, and accomplished some very useful work, some of which has been published. A copy of her paper on "The Oriental species of Stomoxys" is attached.

My own time is so fully occupied in systematic teaching and in imparting a good deal of desultory instruction to former students, who occasionally revisit the school for the special purpose of rubbing up their entomology, that I have little leisure for elaborate research; but thanks to the kindness of the British Museum authorities, I have been able to examine their types of the mosquitoes of the malaria-carrying *Anopheles* group, and I have embodied the results of this examination in a paper "On the classification of the Culicidæ, with special reference to the Constitution of the genus Anopheles," a copy of which is attached.

The study-collections of insects of admitted importance to medical and sanitary officers have been considerably increased, and, besides mounted specimens, we have now between 1,000 and 1,500 preparations suitable for microscopic examination by students. These preparations, as is only to be expected, suffer in use, and their upkeep takes a lot of time.

From His Majesty's Secretary of State for India we have received another volume of the "Fauna of British India," and from His Majesty's Secretary of State for the Colonies a copy of Austen's "Handbook of the Tsetse-Flies" and copies of several issues of the "Bulletin of Entomological Research." To the Trustees of the British Museum we are indebted for copies of Austen's "Handbook" and Theobald's fifth volume of the "Monograph of the Culicidæ." Other additions

to the departmental library include Neumann's "Ixodidae" from "Das Tierreich," and the second part of Nuttall and Warburton's "Monograph of the Ixodoidea."

To the African Entomological Research Committee we owe a large number of specimens of Diptera of pathogenic interest. Also our thanks are due to the following gentlemen for material that has been of the greatest value in our practical class work:—

(*a*) *Africa.*—Dr. A. Connal, Dr. Copland, Dr. A. T. Duke, Dr. A. Hutton, Dr. A. Kennedy, Dr. A. Lundie, Dr. J. S. Pearson, Dr. H. S. Stannus, and Dr. G. A. Turner.

(*b*) *Asia.*—Dr. N. Annandale and the Trustees of the Indian Museum, Dr. J. D. Gimlette, Dr. G. K. Monani, Mr. H. C. Pratt, and Dr. W. Woolliscroft.

(*c*) *America.*—Dr. Charles Eyles and Major Clyde Ford of the United States Army Medical Corps.

(*d*) *Europe.*—Dr. C. W. Daniels and Dr. H. Bayon.

We have also to acknowledge several *desiderata*, in the way of venomous snakes and venomous and poisonous fishes, from Dr. J. D. Gimlette of Kalántan, the Rev. J. W. Hills of Samoa (through Sir Patrick Manson), Dr. A. Hutton of the West African Medical Service, Dr. H. Macfarland of Hongkong, Dr. H. S. Stannus of Nyasaland, Dr. G. A. Turner of Johannesburg, and Dr. W. Woolliscroft of the South Indian Railway.

Numerous inquiries from correspondents in different parts of the world have been answered, and I may mention, in conclusion, that I have just completed a manual of "Entomology for Medical Officers."

A. Alcock,
Lieutenant-Colonel, I.M.S. (retired).

London School of Tropical Medicine,
31st October, 1911.

Enclosure 2 in No. 2.

Report of the Helminthologist for the half year ending November 1st, 1911.

Sir,

I have the honour to submit my report for the half year ending November 1st, 1911, and to forward reprints of five publications made during this period and of seven papers published earlier this year but not available in time to accompany my last report.

My time has been wholly devoted to helminthological teaching and investigation, and during the vacation to the superintendence of the equipment of the new laboratories, which have been under construction for the past six months.

With the approval of Lord Sheffield the School Committee allocated to me a part of the Honourable Stanley Memorial Fund for the year, to enable me to visit the Continental museums and to make myself personally acquainted with the collections of Rudolphi, Diesing, Molin, Mehlis and von Linstow. During May and June I visited Vienna, Göttingen and Leipzig, returning in the latter part of June to hold the usual classes of (*a*) medical, (*b*) advanced helminthology.

At the close of the summer session I attended the Annual Meeting of the National Veterinary Association at Bangor, and opened a discussion on *Sclerostomiasis in Horses.* I also communicated a paper on the *Helminthes parasitic in Equines.* The reports of this meeting are still in the press, and I am therefore unable to append copies at the present time.

During August I remained in London to supervise the transference of the department to its new laboratories, and had the old helminthological and protozoological rooms gutted and converted into a large laboratory for advanced classes.

During September I visited Berlin and Hamburg in continuation of my scheme of work under the Stanley Fund, returning to London at the commencement of the winter session. I hope to embody the result of my investigations on the Continent in a future report. It might be mentioned here, however, that I have been able to determine more accurately than heretofore the exact relationship of

several of the lesser known parasites of man to those which only occur in domesticated animals or in animals living in close association with man under primitive conditions. These determinations necessitate certain changes in the nomenclature of a number of the parasites described from man as they can no longer be regarded as distinct forms. A series of notes on these have been written and await publication in the first number of the Journal of the London School of Tropical Medicine.

During the present year I have received a considerable quantity of material of the hitherto rare parasite of man, *Physaloptera mordens*, and have published a communication on the subject in the Journal of Tropical Medicine, July, 1911.

In August the report of the Grouse Committee of Inquiry was published in book form, and I now have pleasure in submitting a reprint therefrom of my article on *The Development and Bionomics of Trichostrongylus pergracilis*, the causal agent in the production of grouse disease.

In September specimens of a trematode found in Tamils in the Malay States were sent to us by Dr. Stanton of the Kuala Lumpur Research Institute. These proved to belong to a species of *Echinostomum*, new to man. A description of this parasite has been prepared and awaits publication.

Through the kindly interest of Lord Goschen, I had the opportunity during the summer of investigating a fatal outbreak of disease in lambs in Kent. There appears to have been much loss from the same cause in various parts of England, and considerable discussion regarding the exact causation of the trouble has appeared in the "Times." My investigations, which are still in progress, show that the disease is due to a hyper-infection with a considerable number of species of the sub-family Trichostrongylinae, and that the stomach wire worm *Hæmonchus contortus*, does not, of itself, play such an important role in these cases as has been surmised.

During the whole period under review I have received from the Zoological Society the Nematode parasites collected from animals in the Gardens, and have submitted monthly reports thereon.

Bibliographical Work.—By the aid of a grant from the Advisory Committee, we have been able to undertake in a systematic manner the cataloguing and classification of the literature dealing with the parasitic worms of man and the lower animals. During the time that has elapsed, it has been our endeavour to compile a complete list of all recorded genera and species to date from the time of Linnaeus. The references at present, however, only give the original paper in which each parasite was described. We have already accumulated sufficient material to constitute a useful work of reference in connection with the research work of the department, but much more bibliographical research has still to be undertaken before the catalogues can be considered as completed.

Robert T. Leiper.

P.S.—The report of the proceedings of the National Veterinary Association referred to on page 1 has now been received and is enclosed herewith.*

Enclosure 3 in No. 2.

Report of Protozoologist for Six Months ending 31st October, 1911.

During the months of May and June I was engaged in conducting the usual protozoological classes at the London School of Tropical Medicine, both in the ordinary and in the advanced courses. Now that the Protozoological Department has better accommodation in the new laboratories which have been just completed, it is hoped that the advanced courses will be conducted on lines which will prove more advantageous and convenient, not only for the teacher, but also for the students, who previously were much handicapped by the insufficiency of space. The old Helminthological and Protozoological Departments, united into one large room, supply an excellent laboratory for the advanced classes, while the second laboratory in the new buildings is well suited to any students wishing to conduct original investigation, or the examination of material collected in the tropics.

In addition to conducting the classes in protozoology, I completed my examination of the material which I had collected in Bagdad in connection with my investiga-

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* Not reprinted.

tions on Oriental Sore. The results have been published in the last number of the "Journal of Parasitology." There is submitted herewith a copy of the report which is entitled "Oriental Sore in Bagdad, together with Observations on the Gregarine of *Stegomyia fasciata*, the Hæmogregarine of Dogs, and the Flagellates of House-flies." As this report contains an account of the work done on the expedition, there is no need to enter into any further details here.

Towards the middle of June I left England and proceeded to Aleppo in order to continue my investigations on Oriental Sore. I arrived in Aleppo early in July, and at once commenced work in a laboratory fitted up in a quarter of the town likely to yield good opportunities for study.

I soon found that Oriental Sore is not nearly so common in Aleppo as in Bagdad, and I was informed by those well qualified to judge, that in recent years the number of the cases had been diminishing considerably. In spite of this decrease Oriental Sore still remains a serious scourge in Aleppo and other towns of this part of the country (Diarbekir, Urfa, Aintab).

The Oriental Sore differs in no way from that of Bagdad. Both the ulcerating and the non-ulcerating varieties are met with, and these may be either small and insignificant lesions, or large and extensive. It has been claimed that immunity produced by infection with the Aleppo sore does not protect against the Bagdad sore, and *vice versâ*. This may be true to some extent, without there being the necessity of admitting two distinct parasites. It is highly improbable that the disease met with in Bagdad differs essentially from that in Aleppo. In the matter of seasonal incidence, duration of the disease, age at which infection takes place, the part of the body attacked, the diseases of Bagdad and Aleppo are identical.

It was hoped that in the distribution of the blood-sucking arthropoda of Aleppo and Bagdad there would be differences which would lead to the incrimination of one of these. In one respect there was a very marked difference. Whereas the bed bug is exceedingly common in Aleppo, so that scarcely a single house is free from it, in Bagdad, as I have pointed out in a former report, it is rarely met with, and then only in the insanitary prison. The Europeans in Bagdad are unaware of their existence in this town, while in Aleppo everyone knows that they are a very common pest. When we remark that Oriental Sore is commoner in Bagdad than in Aleppo the idea that the bed bug transmits the sore is at once shown to be untenable.

I indicated in a former report that the two mosquitoes—*Stegomyia fasciata* and *Culex fatigans* (?) and *Phlebotamus*—were common biting flies of Bagdad. In Aleppo these three flies were again encountered, and in approximately the same numbers, so that it is impossible to draw any conclusions as to which of these is the probable transmitter. Further, I have evidence that these three blood-sucking diptera are to be met with in most of the large towns of this part of the country, and not only in those where the sore is exceedingly common, but also in places, like Beyrouth, where the sore is only rarely seen. There must be some other factor playing an important part in the distribution of the sore. It is interesting to note that as we pass from Bagdad to Aleppo and from Aleppo to Beyrouth we find the towns becoming more Europeanised. Beyrouth resembles in many ways some of the Italian towns, and in sanitary matters is in advance of Aleppo and Bagdad, where the sore is commoner. As civilisation increases the inhabitants are less likely to leave neglected the unsightly sores which this disease produces. In Bagdad it is very usual to see children playing about the streets with unprotected sores upon the face and affording an opportunity to any fly to take up myriads of the parasites which escape in the exudation. As the inhabitants become more civilised they will cease to neglect the sores in this way, and, being anxious to get rid of the disease, will apply ointments and dressings, which, if they do not hasten the recovery, at least prevent the access of blood-sucking and other flies. It is very probable that this will account for the diminution in the number of cases of Oriental Sore in Aleppo during recent years, and their scarcity in Beyrouth, Smyrna, and some other towns of the country.

I have pointed out in the paper accompanying this report that I was unable in Bagdad to carry out experiments with the "sand fly" *Phlebotamus*. In Aleppo efforts were made to conduct experiments with the object of determining whether the sand fly could transmit the disease. After considerable difficulty a suitable case of non-ulcerating Oriental Sore was persuaded to attend at the laboratory for experimental work. Flies which had been kept in small glass tubes without food for a day or two were placed over the sore. In a certain number of instances they fed upon the sore and became gorged with blood. Owing to the difficulty of conducting these

experiments flies were not dissected to discover if they took up parasites from the sore when feeding in this manner, for I have shown elsewhere that mosquitoes, bed bugs, and *Stomoxys* do so without difficulty, so there is no reason to doubt that *Phlebotamus* would do so likewise. After these flies had fed upon the sore they were kept in the tube for forty-eight hours, and then allowed to feed upon my arm on a certain spot about the size of a shilling. Forty-eight hours later they were fed upon a second spot, and so on till they were found dead in the tube. After feeding four or five times the flies usually died. Only one fly fed six times upon my arm. In this manner some twenty-four flies were fed, representing over eighty feeds on my arm.

1 fly fed 6 times, representing 6 feeds.
5 flies fed 5 times, representing 25 feeds.
6 flies fed 4 times, representing 24 feeds.
7 flies fed 3 times, representing 21 feeds.
2 flies fed 2 times, representing 4 feeds.
3 flies fed 1 time, representing 3 feeds.

The possibility of conducting such an experiment depends, in the first place, on the assumption that the individual experimented upon is not immune; and secondly, that the sore will develop only at the site of inoculation, an assumption which seems to be justified by the experimental work of Nicolle and Manceau in Tunis.

Unfortunately, the number of these experiments is small, but the suspicions of the people, and the difficulty of persuading them, either with or without reward, to submit to experiment was a constant hindrance. Even the case with which these experiments were conducted was very irregular in his attendances, and many times did it happen that I lost whole batches of flies, owing to his refusal to come to the laboratory when they were ready for feeding.

The result of this experiment is so far a negative one, but the incubation period of the disease may be protracted, and there is still a possibility that infection may have taken place.

I was not able to determine if the *Leishmania tropica* underwent any change in *Phlebotamus*. All the flies feeding on the sore were used for the experiments of transmission and, owing to the fact that they were kept in tubes without water, when dead they were invariably too dry for dissection. I discovered that kept in this way, without moisture, the flies fed much more readily on the sore and on my arm.

Dissection of *Phlebotamus* which had not fed upon the sore, and which were caught about the houses, revealed the fact that in 6 per cent. of these a flagellate belonging to the genus *Herpetomonas* occurred. Both round and elongate forms, with and without flagella, were met with in the gut, and it was impossible to distinguish these from the cultural forms of *Leishmania tropica*. This, however, is no evidence that there is any connection between the flagellate of *Phlebotamus* and *Leishmania tropica*. I am unable to bring forward any facts in favour of their identity.

In order to discover if the parasite of Oriental Sore is able to pass through the uninjured skin, as has been demonstrated for trypanosomes, an experiment was performed in the following manner. A small quantity of material, rich in parasites, was obtained by scraping a sore. About five drops of this was placed upon the skin on the upper part of my arm, where it was allowed to dry. The drying process occupied about thirty minutes. There was left an adherent crust which did not separate for two days, care having been taken not to dislodge it. The skin beneath appeared quite normal, and there has not developed any sore at this position. If one can draw conclusions from a single experiment, it would appear that the *Leishmania tropica* cannot penetrate the healthy skin, and further, this would discountenance any view attributing to house-flies the power of producing Oriental Sores by transferring material from a sore to the unbroken skin.

From a microscopical examination of parasites obtained from the sores of Aleppo, I found that they were in every way identical with the parasites of the Bagdad sores. In some films given me by Dr. Altonyan, of Aleppo, and made by him in the year 1888 from the sores of cases in Urfa, Aintab, and Diarbekir, I was able, after staining with giemsa, to demonstrate clearly the typical *Leishmania tropica*. It is interesting to note that these films, made over twenty years ago, still retained the power of taking up the stain, and that the parasites themselves stained quite normally.

Large numbers of house-flies were dissected to see if any light would be thrown on the question of the relation to one another of the various forms of flagellates to be met with. In Bagdad flies, flagellates of three types, might inhabit the gut. These have been described in the accompanying reprint. One of the flagellates showed a peculiar trypanosome structure. It was found on several occasions in the malphigian tubes of flies. In Aleppo this form was never seen, so that it is most probably a distinct flagellate, differing from the *Herpetomonas muscæ domesticæ*, with which it was often associated in Bagdad. The examination of the *Herpetomonas* of the Aleppo flies confirms me in my opinion that the bi-flagellate described by Prowazek is nothing more than a case of precocious flagellum formation in preparation for a subsequent division. A comparison of the figures given by Prowazek with the flagellates in my preparations leaves no room for doubt.

The dogs in Aleppo were found to harbour three blood parasites—*Babesia canis*, *Hæmogregarina canis*, and *Filaria immitis*. In this respect they agree with the dogs of Bagdad. The ticks, presumably *Rhipicephalus sanguineus*, were found upon the dogs in great abundance, and are probably responsible for the transmission of two protozoal parasites. Ticks have been brought home, and I hope to be able to continue my investigations in this country.

As in Bagdad, it is a general belief in Aleppo that dogs suffer from Oriental Sore about the nose and mouth. Though rewards were offered for dogs having sores about the head, nothing resembling an Oriental Sore was seen. If the dogs suffer from the sore, it must be an uncommon occurrence, and dogs cannot play a prominent part in the etiology of the disease. The examination of the organs of eight dogs did not reveal any canine *Leishmaniosis*.

It is probable from accounts of cases I have obtained from Dr. Altonyan and others, that the form of *Leishmaniosis* met with on the northern and southern shores of the Mediterranean occurs also in Aleppo and other parts of Syria. On one very suspicious case, in which there was great enlargement of the spleen and general emaciation, and in which a blood examination showed the condition found in this disease, splenic puncture was performed, but with a negative result.

During my stay in Aleppo I received much assistance from Mr. H. E. Wilkie Young, H.B.M., Consul in Aleppo, and from Dr. Altonyan, who gave me much valuable information on the Oriental Sore in Aleppo and other towns. I take this opportunity of expressing my indebtedness to them.

I left Aleppo on September in order to reach England in time to undertake my duties at the London School of Tropical Medicine in October.

C. M. Wenyon.

APPENDIX V.

Reports from Liverpool School of Tropical Medicine.

No. 1.

LIVERPOOL SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 2 May, 1911.)

Sir, B 10, Exchange Buildings, Liverpool, 1st May, 1911.

As requested, I have the honour to enclose, for the information of the Tropical Diseases Advisory Committee, the following reports of the Liverpool School of Tropical Medicine for the six months ending 30th April, on the work done in connection with the Government Grant, viz.:—

(1) Report of the Walter Myers Lecturer of the School (Dr. J. W. W. Stephens).
(2) Report of the Director of the Runcorn Research Laboratories of the School (Dr. Warrington Yorke).
(3) Report of the Lecturer in Medical Entomology (Mr. Robert Newstead).

The report of the work done by the special research workers at the School will be sent later, in accordance with the arrangement made by Professor Ross with your Department.

I am, &c.,
A. H. MILNE,
Secretary.

Enclosure 1 in No. 1.

SIR, B 10, Exchange Buildings, Liverpool, 29th April, 1911.

I BEG to submit the following report on the work done during the period from November 1st, 1910, to the 31st April, 1911 :—

Students.

The number of medical men who attended the Autumn Term was 25, and the number for the Lent Term 16, total 41. This number includes members of the Royal Army Medical Corps, Indian Medical Service, West African Medical Staff, Colonial Medical Service, &c.

Diploma of Tropical Medicine.

The number of candidates who entered for the examination in December was 20, of whom 18 passed. The number of candidates for the April examination was 14, of whom 12 passed.

Museum.

The thanks of the School are due to the following gentlemen for their kindness in sending specimens to the School during the last six months :—

Dr. H. Wolferstan Thomas, Expedition to Manaos, Brazil; Dr. J. Bell, Hong Kong; Dr. Jeffreys, Shanghai; Colonel J. R. Adie, I.M.S., Ferozepore; Captain R. Markham Carter, I.M.S., Kasauli; Dr. J. Bruce, Portuguese East Africa; Dr. M. W. Manuk, Lokoja; Mr. Middleton, Calcutta; Dr. Buchanan, Liverpool; Dr. C. Mackey, Belize, British Honduras; Dr. T. Gann, Belize, British Honduras; Major S. R. Christophers, I.M.S., Kasauli.

Research Work.

T. rhodesiense.—I am continuing, together with Dr. Fantham, our researches into the nature of this human trypanosome, which we think is a new one, and for which we proposed the name *T. rhodesiense.* We are investigating the trypanosome by Colonel Bruce's method of measurement, but owing to the laborious nature of this work, we have so far only measured about 500 trypanosomes. It apparently is necessary to measure at least 1,000 before a typical curve of length can be obtained. We hope to finish these measurements during the course of this summer.

My report on the anti-malaria measures at Ismailia, which has been delayed for several reasons, is now complete, and I hope to publish it in a forthcoming number of the Annals of Tropical Medicine and Parasitology.

Opisthorchis noverca.—Recently among a collection of specimens presented to the Museum by Captain R. Markham Carter, I.M.S., I came across a couple of flukes labelled *Distomum truncatum*, from the Indian pariah dog. On examining these I found that they were spined flukes, which corresponded approximately to the description of these flukes given by Lewis and McConnell about 35 years ago from dog and man respectively. These flukes have not been described since that time, consequently I have determined to redescribe them. They are the flukes which have been renamed by Braun *O. noverca.* From an examination of the original figures and descriptions, I am uncertain as to whether the flukes described by Lewis and McConnell from dog and from man respectively are the same. The flukes which I have examined correspond fairly closely in size, at least, with the description of Lewis of the dog fluke, whereas the human flukes of McConnell are considerably larger.

International Hygiene Exhibition, Dresden.

At the request of the Secretary of State for the Colonies, the School authorities decided to send an exhibit illustrative of their scientific work to the forthcoming exhibition in June. The preparation has been entrusted to Mr. Newstead and myself, and is now in a state of active preparation. We propose to illustrate the mode of transmission of some of the more important tropical diseases by insects, &c.

I have, &c.,
J. W. W. Stephens,
Walter Myers Lecturer in Tropical Medicine.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings,
Liverpool.

Enclosure 2 in No. 1.

Runcorn Research Laboratories, Crofton Lodge,
Runcorn, 29th April, 1911.

Sir,

I have to submit the following report on work done in the Runcorn Research Laboratories of the Liverpool School of Tropical Medicine during the period from November 1st to April 30th, 1911.

The grant has been utilised for defraying the current expenses of the laboratory, for the purchases and maintenance of experimental animals necessary for the preservation of the various kinds of trypanosomes and other protozoa required for teaching purposes and for carrying on research work in the laboratory.

During the past six months we have added several strains of trypanosomes to our collection, and at the present time we have here, preserved in experimental animals, ten strains of trypanosomes in addition to spirochætes and piroplasma canis.

Dr. Blacklock was appointed in the place of Dr. R. W. Nauss, who left at the beginning of April.

I have completed my work on the pathogenicity of *T. rhodesiense*, and the results obtained confirm the opinion expressed by Stephens and Fantham on morphological grounds that this species is distinct from the ordinary human trypanosome of *T. gambiense*.

A number of animals (three goats and a horse) infected with this trypanosome (*T. rhodesiense*) developed marked interstitial keratitis. Microscopical examination of the eyes of these animals showed the condition to be due to an enormous multiplication of the parasite in the tissue spaces of the *substantia propria*. As the animals in question exhibited exceedingly few trypanosomes in the peripheral blood, this observation is of considerable interest.

In the course of experiments on the subject of auto-agglutination of red blood cells in Trypanosomiasis, I observed that if a suspension of active trypanosomes were incubated with blood in a sealed glass tube, the colour of the erythrocytes speedily changed to a dark purple. Dr. Nauss and I have investigated the cause of this phenomenon, and have found that it was due to the fact that actively motile trypanosomes exert a marked reducing action on solutions of such substances as methylene blue and oxyhæmoglobin. We have further performed quantitative experiments with a view to ascertaining the amount of oxygen absorbed by trypanosomes at 37° C. in a given time. A report of this work is awaiting publication.

We have also conducted experiments with the object of investigating the mechanism of suppression of urine in blackwater fever. Our observations have thrown interesting light on this important subject. A report of these experiments is in the course of preparation, and will shortly be ready for publication.

In association with Dr. H. S. Stannus, of the Nyasaland Medical Staff, I have examined the parasite from a case of sleeping sickness contracted in the Protectorate. As a result of our work we are convinced that the trypanosome infecting in this case is not *T. gambiense*, but is probably identical with *T. rhodesiense*. A paper on this subject is awaiting publication.

The following papers on work done in the laboratory have been published since November 1st, 1910 :—

On the Pathogenicity of a Trypanosome (*T. rhodesiense*) from a case of sleeping sickness contracted in Rhodesia, by Warrington Yorke. Annals of Tropical Medicine and Parasitology, 1910, Vol. IV., No. 3, p. 351.

Auto-agglutination of Red Blood Cells in Trypanosomiasis, by Warrington Yorke, Roy. Soc. Proc., 1911, B.Vol. 83, p. 238.

A Note of the Pathology of Lesions of the Cornea and skin in Animals Experimentally Infected with *T. rhodesiense*, by Warrington Yorke. Annals of Tropical Medicine and Parasitology, 1911, Vol. IV., p. 385.

I have, &c.,
WARRINGTON YORKE,
Director of Runcorn Research Laboratories.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings,
Liverpool.

Enclosure 3 in No. 1.

B 10, Exchange Buildings Liverpool, 29th April, 1911.

DEPARTMENT OF MEDICAL AND GENERAL ECONOMIC ENTOMOLOGY.

SIR,

I HAVE the honour to submit the report bearing upon the work in connection with the Entomological Department of this School for the half-year ending April 30th, 1911.

Students.

The number of students who attended the special and the full course of instructions respectively, is as follows :—

(A.) Special Entomological Course as per syllabus submitted to the Colonial Office—4th term, commencing March 20th	7
(B.) Lent Term (full course)	16

Papers published :—

1. On the Yellow Fever Mosquito (*Stegomyia calopus*) and its nearest allies. Contribution to Sir Rubert Boyce's Paper. Bulletin Ent. Res. Comm. (Colonial Office), Vol. 1, pp. 240-248. Three figs.
2. On three new species of the Genus Glossina, together with a description of the hitherto unknown male of *Glossina grossa*, Bigot. Ann. Trop. Med. and Parasit., Vol. IV., pp. 369-375. (Copy submitted.)
3. Descriptions of a new Genus and three new Species of Anopheline Mosquitoes (joint with Mr. H. F. Carter). Ann. Trop. Med. and Parasit., Vol. IV., pp. 377-383. Two plates. (Copy submitted.)
4. On a new Genus of Culicidæ from the Amazon Region. Ann. Trop. Med. and Parasit., Vol. IV., No. 4, March, 1911, pp. 553-556. (Joint with Mr. H. F. Carter.) (Copy submitted.)
5. On a Collection of Coccidæ and Aleurodidæ, chiefly African, in the Collections of the Berlin Zoological Museum. Sonderabdruck aus: Mitteilungen aus dem Zoologischen Museum in Berlin. V. Band, 2. Heft. 1911. (Copy submitted.)
6. The Papataci flies (*Phlebotomus*) of the Maltese Islands. With three plates and some thirty figures in the text. Bulletin of the African Entomological Research Committee, Vol. 2. This paper is now passing through the press. It forms the Official Report of the Twenty-third Expedition of the Liverpool School of Tropical Medicine. A copy of the paper will be submitted as soon as issued.
7. A Revision of the tsetse-flies (*Glossina*), based on a study of the male genital armature. Bulletin of the African Entomological Research Committee. Vol. II. This paper is now passing through the press, a galley-proof of which is submitted.

In the preface of this paper I have stated: " The scheme of classification of the members of this small, but very highly specialised genus, herein adopted, is, I believe, contrary to nearly every precedent, in so far as it begins with the lower and rises to the higher or more complex forms. It is based entirely upon the taxonomic characters of the armature of the males, which afford a natural and reliable guide for discriminating the superficially similar species, and indicate very clearly the alliances and distinctions which exist among these insects. That the species fall into three very striking and distinct groups may be easily gathered from a study of the ilustrations accompanying this memoir, each group being distinguished by very trenchant characters. These are:—

Group I.—The Fusca Group.

This division includes the four largest species of the genus: *G. fusca*, Walk., and *G. nigrofusca*, Newst., which have a western distribution; *G. longipennis*, Corti, and *G. brevipalpis*, Newst., occurring chiefly on the eastern side of the continent. In all of these species the superior claspers are quite free, there being no membrane stretching between them; the distal extremities of these appendages have either a single large and bluntly-pointed tooth-like extension, or they are bluntly bidentate; the harpes in all cases being markedly different in structure.

Group II.—The Palpalis Group.

To this division belong the following species:—*G. palpalis*, R.D., *G. tachinoides*, Westw., *G. fuscipes*, Newst., *G. caliginea*, Aust., and *G. pallicera*, Big. In all of these the superior claspers of the males are connected by a thin and finely-spinose membrane which is deeply divided medially, but in all cases the distal extremities of the claspers are quite free and widely separated. In *G. palpalis* and *G. tachinoides* the claspers are identical in structure, though generally those of the latter are relatively smaller; in both species, also, the distal portion is produced into a single more or less falciform or tooth-like process. The claspers in *G. pallicera* are suddenly truncated* at the distal extremity, the inner half of which is furnished with minute spines; furthermore, they are much broader basally than in the other species which are included in this group.

Group III.—The Morsitans Group.

This group comprises *G. morsitans*, Westw., *G. submorsitans*, Newst., *G. pallidipes*, Aust., and *G. longipalpis*, Wied. In these the superior claspers are completely united by a spinose membrane and they are also fused medially, their shape somewhat resembling the scapula of a mammal in miniature, and they are altogether much more highly complicated structures than those in either of the preceding groups.

Thus we see, in these three groups, forms which are so widely different as to lead one to assume, without taking the other external features into consideration, that they represent three distinct genera. Certain it is that these insects afford an interesting illustration of the fact that a high degree of differentiation in one set of morphological characters is not incompatible with the retention of others apparently of a more ancestral type.

I have, &c.,

ROBERT NEWSTEAD,

Lecturer in Medical Entomology.

The Secretary,

Incorporated Liverpool School of Tropical Medicine,

B 10, Exchange Buildings,

Liverpool.

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* The distal margin may eventually be found to possess a tooth-like process similar to that in other members of this group, but there is no trace of these in the example before me; further details cannot be given until more material comes to hand.

No. 2.

LIVERPOOL SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 1 November, 1911.)

Sir, B 10, Exchange Buildings, Liverpool, 31st October, 1911.

I have the honour to enclose, for the information of the Tropical Diseases Advisory Committee, the following reports of the Liverpool School of Tropical Medicine for the six months ending 31st October, showing the manner in which the Government grant to the school has been expended, viz. :—

(1) Report of the Walter Myers' Lecturer of the School (Dr. J. W. W. Stephens).

(2) Report of the Acting Director of the Runcorn Research Laboratories of the School (Dr. B. Blacklock).

(3) Report of the Assistant Lecturer in Medical Entomology (Mr. H. F. Carter).

(4) Report of Professor Sir Ronald Ross, showing the work which has been done in connection with the special grant of £262 made to the school by the Tropical Diseases Advisory Committee for 1911.

I am, &c.,
A. H. MILNE,
Secretary.

Enclosure 1 in No. 2.

Sir, B 10, Exchange Buildings, Liverpool, 25th October, 1911.

I beg to submit the following report on the work done during the period from May 1st to October 31st.

Students.

The number of medical men who attended the June short course was 3, and for the autumn term 13; total 16. These include members of the Royal Army Medical Corps, Indian Medical Service, West African Medical Staff, Colonial Medical Service, &c.

Diploma of Tropical Medicine.

During the last six months no examination for the diploma has been held. The next examination takes place on December 11th.

Museum.

The thanks of the school are due to the following gentlemen for their kindness in sending specimens to the school during the last six months :—

Dr. W. J. Bruce, Portuguese East Africa; Dr. J. H. H. Harrison, Belize, British Honduras; Major S. R. Christophers, I.M.S., Kasauli; Dr. M. W. Manuk, Lokoja; Dr. G. E. H. Le Fanu, Gold Coast; Colonel Adie, I.M.S., Lahore; Dr. Mackey, British Honduras; Dr. Jackson Moore, Gold Coast.

Research Work.

T. rhodesiense (Stephens and Fantham).—During the summer Dr. Fantham and myself continued our studies of this new human trypanosome which, it may be recalled, was observed in a case of sleeping sickness from Rhodesia, and in which we saw morphological peculiarities that have not ever been seen before and which we ourselves failed to observe in *T. gambiense.* Our further observations have consisted in measuring a thousand specimens of the trypanosome in the way that Sir David Bruce introduced for the distinction of different species. We found it advisable to modify his method in some respects.

(1) Instead of drawing the trypanosomes with a camera lucida, it is much easier to project them on a screen in a dark room and then to trace them. The magnification is verified by projecting a millimetre scale in the same manner. This method not only saves much eye-strain in drawing but also is much quicker.

(2) A more important modification consists in the actual mode of measuring the trypanosomes drawn on paper. Sir David Bruce uses for this purpose a pair of compasses set at a fixed distance (2 mm.). There are, however, two objections to this method :—

(*a*) It cannot and does not give an accurate measurement because the compass makes a series of " jumps," and theoretically and actually the measurements given are always less than the true one.

We can illustrate our objections perhaps by supposing we have to measure the curve made by the teeth of a saw. If the teeth are equal and the distance between the compass points is equal to the depth of a tooth, then the curve could be measured; but if the depth of the teeth are unequal, then it would be impossible to get an accurate measurement, but this could be accurately done by the " tangent line " method. Although the curves of a trypanosome do not change their direction like those of a saw, yet the curves often do change their direction and the principle of the objection remains. We, therefore, used the method which we call the " tangent line method," which, though difficult to explain in words, is very simple in practice. The requirements are : (1) a piece of tracing paper on which a straight line is drawn in ink, (2) a pin, (3) a millimetre scale. The tracing paper is placed over the drawing of the trypanosome which is seen through it. When the tracing paper is fixed by slight pressure of the pin placed on the ink line, it can now be rotated and the most tortuous curves followed with ease. One end of the ink line is placed on one end of the trypanosome. If the axis of the trypanosome curves, for example at the nucleus, the pin is placed at this point and the paper is now rotated until the ink line coincides with the new direction of the axis. This is done as often as is necessary, and, in fact, the sharpest curves can be followed in this way, which is impossible by a compass the points of which are at a fixed distance. Finally the other end of the trypanosome is reached, the pin is placed at the other extremity, and the actual extent of the ink line traversed measured by the millimetre scale. Further, it has the advantage that it can equally well be applied to the measurement of any other curved line, *e.g.*, a spirochæte which, even if it could be measured by a compass, would certainly give a most erroneous result.

(*b*) Another objection to the compass method is that, if we start at the " head " of the trypanosome we can never be certain that we shall finish *exactly* at the " tail " end. If not, there is always a portion of a compass distance which has to be guessed. With the tangent line method this is avoided, and we finish exactly at the end.

We would suggest, therefore, that our method should replace that used by Sir David Bruce, as we think that there can be no doubt that it is more accurate and in practice is perfectly simple.

Another suggestion we have to make is that trypanosomes should always be measured in the same animal as we have ourselves observed, and we believe that it is generally recognised that the morphology of a trypanosome varies—sometimes considerably—in a different host. We would suggest, therefore, that the pathogenic trypanosomes should always be measured in white rats when this is possible, and that it should always be stated on what day of the infection so many trypanosomes were measured.

As to the results obtained by us by measuring 1,000 specimens of *T. rhodesiense*, we are not in a position at present to discuss them, as at present the curve of similar measurements of *T. gambiense* by Sir David Bruce has not been published; but our measurements are completed, and we hope to present our results to the Royal Society at the earliest opportunity.

It is of interest to point out that a second case of *T. rhodesiense* infection has been recorded and described by Stannus and Yorke from a European in Nyasaland.

The Anti-Malarial Campaign at Ismailia.

My study of the campaign initiated at Ismailia by Sir Ronald Ross was published in the " Annals of Tropical Medicine and Parasitology," Vol. V., No. 2.

Considerable difficulty was experienced in obtaining early literature bearing on the subject, which has accounted for the delay in completing this paper. My investigation shows, I think, that malaria was present in the Isthmus of Suez from the earliest times, and that it did not owe its origin to the enlargement of the Sweet Water Canal in 1877, as has been very generally stated. The results of the campaign were a complete success. I endeavoured to show how this success was attained, and I mention the following factors as being of the greatest importance:—

(1) Ismailia is in the desert (many of the breeding places could readily be filled with sand, easily obtained from sand dunes, and so not necessitating the formation of borrow-pits).
(2) The intermittent irrigation system with a fall of 20 feet.
(3) The presence of fish in all the drains.

Trypanosome Nomenclature.

I have in preparation a paper on this subject. Adhesion to the laws of nomenclature is as necessary in this branch of zoology as elsewhere. Great confusion has arisen in the literature over the so-called trypanosome *T. dimorphon*, Dutton and Todd. The confusion arises partly from the fact that a trypanosome *T. dimorphon*, Laveran and Mesnil, also is described. I was much surprised recently in consulting the original papers to find that, as a matter of fact, Dutton and Todd never named their trypanosome (the Gambian Horse trypanosome) in spite of the universally assumed statements to the contrary. I think *primâ facie* this name is accordingly a *nomen nudum*, but I propose to discuss this and other names in full in my paper.

Opisthorchis noverca.

As stated in my last report, I had " rediscovered " this fluke, first described by Lewis in 1872, among some material kindly sent to me from India by Captain Malcolm Carter, I.M.S.; I had only two specimens at my disposal, and I was unable to make out clearly several anatomical structures in this material. I have at last obtained a further supply of this interesting Trematode, which appears to be quite common in Indian dogs in certain districts, and I hope to be able to complete my descriptions and to correct the text-book descriptions at an early date.

A new genus of Monostome Flukes.

Professor Newstead on his return from Jamaica kindly presented me with some flukes from a Nicaraguan turtle which died on board ship. They evidently belong to a new species and a new genus, and I have proposed the name *Desmogonius desmogonius* for this fluke, and have published a description of it in the current number of the " Annals of Tropical Medicine and Parasitology," Vol. V., No. 3.

International Hygiene Exhibition, Dresden, 1911.

A small but fairly complete exhibit illustrating mainly the mode of conveyance of some of the chief tropical diseases by insects was prepared by Professor R. Newstead and myself for the British section. These exhibits consume much time in their preparation, but we are informed by the secretary of the section that our efforts towards making the British section a success were much appreciated.

I am, &c.,
J. W. W. Stephens.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings, Liverpool.

Enclosure 2 in No. 2.

Runcorn Research Laboratories,
Crofton Lodge, Runcorn, 31st October, 1911.

Sir,

I have the honour to submit the following report on the work carried on in the laboratories during the six months from May 1st to October 31st, 1911.

The grant has been expended on the upkeep of the laboratories, in meeting the cost of maintaining the strains of trypanosomes, and in conducting research.

Dr. Warrington Yorke, Director of the Laboratories, having been requested by the British South Africa Company to investigate the cause of the spread of sleeping sickness in Rhodesia, obtained leave of absence from the Committee of the School for the period of one year, and left for the Luangwa Valley, North-Eastern Rhodesia, on August 26th, 1911. I have been appointed Director of the Laboratories during his absence.

The following is a brief summary of the research work done in the laboratory during the past six months.

Yorke and Nauss have completed their investigations upon the mechanism of the production of suppression of urine in blackwater fever. They have succeeded in producing suppression of urine in normal rabbits by the intravenous injection of homologous hæmoglobin. They arrived at the conclusion that suppression of urine in blackwater fever was of mechanical origin, depending upon the occlusion of the renal tubules by casts derived from hæmoglobin. In a paper read at the British Medical Association Meeting at Birmingham in July, 1911, Dr. Yorke referred to various points in the treatment of the condition in man which had been suggested by his experimental researches upon animals.

Dr. Yorke has continued his investigation upon this subject with the especial object of ascertaining the precise manner in which hæmoglobin is eliminated by the kidneys. He has come to the conclusion that hæmoglobin is excreted by the epithelium lining certain portions of the renal tubules, and that, in contradistinction to the view generally held, it does not pass through the glomeruli. A report of this work is awaiting publication.

Jointly with Dr. J. O. Wakelin Barratt, Director of the Cancer Research Laboratory, University of Liverpool, Dr. Yorke conducted a further research on hæmoglobinaemia, which will shortly form the subject of a further communication. This research has been specially directed towards the elucidation of several hitherto obscure points arising in connection with blackwater fever and forms a continuation of the work appearing in previous communications.

In the month of June, 1911, we obtained by the kindness of Professor Todd, formerly of this school, a horse from the Gambia naturally infected with trypanosomiasis. In view of the fact that very considerable discussion has arisen as to the type of the trypanosome affecting horses in the Gambia, described in the original publication of Dutton and Todd on this subject, Dr. Yorke and I decided to examine as thoroughly as possible the trypanosome found in this particular animal, and the work which we considered necessary to undertake has revealed several very important facts, not only as regards the morphology of the parasite in the horse and in a large series of animals experimentally inoculated from it, but also as regards the pathogenicity of the parasite found in respect to laboratory animals.

As a result of our joint work, we have come to the conclusion that the horse sent to us is not suffering from an infection due to the original *T. dimorphon* of Dutton and Todd. The horse contained parasites in its blood, a long form with a free flagellum, and also a short form without a free flagellum; the former we consider from its morphological appearance and animal reactions to belong to the *T. vivax* group. As regards the latter, we had not been able to decide absolutely before Dr. Yorke left whether it was simply a modification of the former or a distinct trypanosome. We have been able to infect rabbits with the free flagellated form. At present further experiments are being done to decide the question of double infection.

The following papers on work done in the laboratories have been published during the last six months:—

(1) Ralph W. Nauss and Warrington Yorke. Reducing Action of Trypanosomes on Hæmoglobin. "Annals of Tropical Medicine and Parasitology," Vol. V., No. 2, August, 1911.

(2) Warrington Yorke and Ralph W. Nauss. The Mechanism of the Production of Suppression of Urine in Blackwater Fever. "Annals of Tropical Medicine and Parasitology," Vol. V., No. 2, August, 1911.

(3) Report of a paper on the above read at the Tropical Section of the British Medical Association Meeting at Birmingham. "Lancet," 1911, Vol. II., p. 527; "British Medical Journal," August 5, 1911, p. 286.

(4) Hugh Stannus and Warrington Yorke. The Pathogenic Agent in a Case of Human Trypanosomiasis in Nyasaland. "Proc. Roy. Soc., B," Vol. 84, 1911.

(5) Warrington Yorke. The Pathology of Interstitial Keratitis in Trypanosomiasis and Syphilis. "Liverpool Medical Chirurgical Journal," Vol. XXXI., July, 1911.

(6) Warrington Yorke and B. Blacklock. The Trypanosome found in two horses naturally infected in the Gambia. (Shortly to appear.)

I am, &c.,
B. Blacklock,
M.D., D.P.H.

The Secretary,
Incorporated Liverpool School of Tropical Medicine.

Enclosure 3 in No. 2.

Department of Medical and General Economic Entomology.

Sir, B 10, Exchange Buildings, Liverpool, 18th October, 1911.

Owing to Professor Newstead's absence from the School, I have been requested to submit the following report, bearing upon the work of this department for the half year ending October 31st, 1911.

Students.

The number of students who attended the special and full courses of instruction, is as follows:—

A. Special Entomological Course as per syllabus submitted to the Colonial Office: 5th term commencing June 26th ...	9
B. Summer Term (short course)	3
C. Autumn Term (full course)	13

Papers published.

1. The Papataci flies (Phlebotomus) of the Maltese Islands. "Bulletin of the African Entomological Research Committee," Vol. II., Part I., and Annals of Trop. Med. and Parasit., Vol. V., No. 2, pp. 139-181. (R. Newstead.)
2. A revision of the tsetse-flies (Glossina), based on a study of the male genital armature. "Bulletin of the African Entomological Research Committee," Vol. II., Part I. (R. Newstead.)
3. A new mosquito from Uganda. "Bulletin of the African Entomological Research Committee," Vol. II., Part I. (H. F. Carter.)
4. On the genital armature of the males of *Glossina medicorum*, Austen, and *Glossina tabaniformis*, Westwood. "Bulletin of the African Entomological Research Committee," Vol. II., Part II. (R. Newstead.)
5. Observations on African scale insects (Coccidae), No. 3. "Bulletin of the African Entomological Research Committee," Vol. II., Part II. (R. Newstead.)
6. On a new genus of psyllidae from Nyasaland. "Bulletin of the African Entomological Research Committee," Vol. II., Part II. (R. Newstead.)
7. On some new species of African mosquitoes (Culicidae), "Ann. Trop. Med. and Parasit." Vol. V., No. 2, pp. 233-242. (R. Newstead and H. F. Carter.)

Identification of blood-sucking flies and other insects of economic importance.

A number of insects have been sent in for identification purposes, and some valuable additions to the museum have also been received. For the latter, the thanks of the school are due to the following gentlemen:—

Rev. J. Aiken (collection of mosquitoes from British Guiana).
Major S. R. Christophers (collection of Indian anopheline mosquitoes).
Dr. J. W. Hanington (dipterous larvæ extracted from a case of myiasis, Mexican tabanidae and ticks).
Dr. G. E. H. Le Fanu (ticks, mosquitoes and tsetse flies from the Gold Coast).
Dr. H. Wolferstan Thomas, expedition to Manaos, Brazil (mosquitoes and other insects).
Major E. L. Perry (collection of Indian anophelines).

Dr. R. McConnell (tsetse-flies, tabanids and hymenoptera from Uganda).
Dr. H. Palmer (mosquitoes, tsetse-flies, and tabanids from the Gold Coast).

I have, &c.,
H. F. Carter,
Assistant Entomologist.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings, Liverpool.

Enclosure 4 in No. 2.

Sir, B 10, Exchange Buildings, Liverpool, 24th October, 1911.

I beg to enclose herewith three reports for the information of the Advisory Committee of the Tropical Diseases Research Fund. These reports describe work done directly under me in consequence of the special grants made to this school by the Committee at the end of 1909, and at the end of 1910 for the study, respectively of malaria, pathological chemistry, and amœbic dysentery. The reports are as follows:—

I. By Dr. David Thomson on work done on malaria.
II. By Dr. G. C. E. Simpson on his chemical researches.
III. By Dr. H. B. Fantham on work done upon amœbic dysentery and other subjects.

The reports deal in brief with the whole work under each grant from the 1st January, 1910, until the end of June, 1911. Interim reports have already been forwarded to the Colonial Office, and the present reports are therefore of the nature of general summaries.

The total sum of money allotted for the work by the Colonial Office from the 1st January, 1910, to the 31st June, 1911, was as follows:—

1. For malaria	£375
2. For chemistry	225
3. For amœbic dysentery...	312
Total	£912

It will be observed that this sum has paid for the investigations of three different workers during nearly 18 months. As Dr. Fantham did not commence his work until April, 1910, the total time expended on all the investigations together, amounts to 51 months, at a cost of less than £18 a month.

I am, &c.,
Ronald Ross.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
Liverpool.

I.

Sir, Royal Southern Hospital, Liverpool, 6th October, 1911.

In accordance with your request, I write the following report, for the Advisory Committee of the Colonial Office, on the researches which I have made in malarial fever, &c., under your direction and guidance:—

Report on the Research into Malarial Fever, &c., carried on in connection with the grant given by the Colonial Office, from January 1st, 1910, till October, 1911.

This research, clinical and pathological, has been conducted at the Royal Southern Hospital, Liverpool, in connection with the ward for tropical diseases. A laboratory containing the most necessary equipment for research has been fitted up at the above hospital by the Liverpool School of Tropical Medicine. This laboratory is adjacent to the tropical ward, which has beds for twelve patients, so that the clinical and pathological studies of the diseases may be carried on together. Although the research has been especially directed towards malarial fever, yet the opportunities for studying any other tropical case of interest which might happen to come into the ward were not lost. A case of sleeping sickness in a young Englishman, contracted in North-Eastern Rhodesia, was especially studied during

a period of seven months, and other minor researches have been made on a case of blackwater fever and a case of leprosy.

A.—Synopsis of Researches on Malarial Fever.

These researches have been conducted on somewhat improved lines. The disease has been studied from hour to hour and from day to day over periods varying from about one to eight weeks, in every possible aspect, both in treated and untreated cases. Clinical observations were carried on simultaneously with continuous enumerative observations on the blood. Hitherto it had been found impossible to estimate, even with remote accuracy, the number of malarial germs in a given volume of blood. By working on the principle of Ross's thick film process, however, a new method and a new apparatus has been devised and developed, whereby the number of parasites and leucocytes, &c., in the blood can be quickly and repeatedly determined with considerable accuracy.* These repeated and simultaneous clinical and enumerative observations which were carefully charted together, have proved to be a very fruitful source of hitherto undiscovered facts, the details of which may be found in the various publications mentioned at the end of this report. The bare facts only are here recorded of the 81 cases of malaria (62 *P. falciparum*, 17 *P. vivax*, and 2 *P. malariæ*) studied in this way.

The facts and conclusions obtained up to the present time from these cases are as follows:—

1. There is a very decided correlation between the number of asexual parasites found in the peripheral blood and the fever. The greater the number of these parasites present, the greater is the resulting fever.
2. As a rule no fever exists unless the asexual parasites exceed some hundreds per c.mm. of blood, so that a person may have many malarial germs in his blood and yet carry on his work fairly well without symptoms of fever.
3. The asexual forms do not always disappear between relapses, as often thought, but tend to persist in small numbers per c.mm. of blood and often increase again for some days before the actual febrile relapse occurs.
4. These observations give a coherent theory of the malarial invasion, according to which the infection is kept alive indefinitely by the ordinary sporulation of the asexual forms, and not by parthenogenesis or by resistant forms, and fever occurs only when the parasites are numerous enough to produce it.
5. It is estimated that considerable continued doses of quinine reduced the asexual forms by 50 to 80 per cent.
6. Soamine, X-rays, and faradic and galvanic currents had no results in a few experiments.
7. The hæmoglobin falls markedly with fever but rises rapidly with convalescence.
8. Crescents are produced from the ordinary asexual spores of *P. falciparum* owing to a development of immunity towards the latter.
9. The crescents develop somewhere in the internal organs and then appear suddenly in the peripheral blood. The period required for their development is about 10 days.
10. Crescents do not generally live more than a few days in the peripheral blood.
11. Crescents may be present in the peripheral blood during periods as long as eight weeks, not because the individual crescents survive for that time, but because their numbers are constantly replenished from surviving asexual forms.
12. Fresh broods of crescents come into the circulating blood daily, or every other day, or irregularly, according as the asexual sporulation occurring ten days before was quotidian, tertian, or irregular.
13. Quinine has no destructive action on crescents, either during their development or afterwards, but it destroys the asexual source of supply.
14. Quinine reduces the crescents to numbers less than one per c.mm. of blood within three weeks, provided it be given in daily doses of twenty to thirty grains.
15. Quinine in small doses tends to increase crescent production (?) by favouring the development of immunity to the asexual parasites.
16. Methylene blue in doses of twelve grains daily reduces the number of crescents, and would seem to have some direct destructive action upon them.

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* Further described in the accompanying report by Dr. Fantham.

17. Conclusions regarding prophylaxis :—

(*a*) It is bad practice to give quinine in small doses of five grains daily or irregularly, even though the dose be large, for such treatment tends to increase the power of crescent formation.

(*b*) All cases of malaria should be treated early and continuously with doses of quinine of about 20 to 30 grains daily, as such treatment during and after the fever diminishes the subsequent formation of crescents. Continuous treatment with the above doses renders infective cases of malaria non-infective to mosquitoes in a period not exceeding three weeks.

18. During active malaria the number of leucocytes in the peripheral blood is decreased. During quiescent malaria and in cases apparently cured by treatment the leucocytes in the peripheral blood are much increased.

19. In these apparently cured cases of malaria the mononuclear percentage is lowest at the time of the day at which the rigor and fever occurred during the previous active malaria; and, moreover, at this time there also occurs a very marked leucocytosis, consisting of polynuclears, which continues only for a few hours. The leucocytes often reach numbers as great as 30,000 to 50,000 per c.mm. of blood. On one occasion they were as numerous as 125,000 per c.mm. This post-malarial phenomenon occurred always without exception in the forty cases examined and would, therefore, seem to be a very pathognomic sign of previous malaria.

20. It would appear that large numbers of malarial parasites on sporulating cause a leucopenia, while a very small number on sporulating cause a leucocytosis.

21. Quinine has never failed in any of our cases of malarial fever to destroy the sexual parasites with remarkable rapidity, provided it be given in doses of 10 grains thrice daily. With such treatment it is almost impossible to detect these parasites in the blood after a period of three days.

22. No true relapses have occurred during such treatment. Though in 15 per cent. of the cases a pseudo-relapse has occurred, that is to say, a transient rise of temperature took place, during which no parasites could be detected in the blood, this transient fever was probably due to some other cause than malaria.

23. That any cases of malaria are resistant to quinine cannot be accepted until further proof has been brought forward.

24. Quinine is vastly superior to any other drug yet tested by us in the treatment of malaria.

Further researches are at present in progress with a view to determining the best methods and forms of administering quinine and to determine which part of the quinine molecule is most detrimental to the malarial parasite.

The details regarding the above conclusions have been published as follows :—

Conclusions 1 *to* 7, *inclusive.*

"Some Enumerative Studies on Malarial Fever." Ross and Thomson. "Proc. Roy. Soc. B.," Vol. 83, 1910.

Conclusions 8 *to* 17.

"A Research into the Production, Life, and Death of Crescents in Malignant Tertian Malaria, in Treated and Untreated Cases, by an enumerative method." Thomson. "Annals of Trop. Med. and Parasit.," Vol. V., No. 1, April, 1911.

Conclusions 18 *to* 20.

"The Leucocytes in Malarial Fever; a method of diagnosing Malaria long after it is apparently cured." Ibid.

Conclusions 21 *to* 24.

"Pseudo Relapses in Malarial Fever during continuous Quinine Treatment." Ross and Thomson. Not yet published.

B.—Researches on a Case of Sleeping Sickness: Conclusions.

1. The number of trypanosomes in the peripheral blood increase and fall in a regular cyclical manner, the periods between the rises being about seven days.

2. There is a definite correlation between rises in temperature and rises in the number of trypanosomes.

3. The number and variety of leucocytes show a similar periodic variation. The numbers are high, with an excess of mononuclears, during the trypanosome fall and *vice versa.*

4. Atoxyl in moderate doses had little curative effect on this case of Rhodesian sleeping sickness.

5. The injection of trypanosome vaccines stimulated the trypanosomes to increase in number, but this increase was followed by a rapid fall.

6. Subcutaneous injections of leucocytic extract caused a marked leucocytosis and on one occasion was followed by a marked improvement.

7. The cyclical increase of trypanosomes is due to their active multiplication, the rate of multiplication depending on the following conditions :—

(*a*) The liberation of a reproductive stimulant from the dead trypanosomes of the previous fall.
(*b*) The small number of leucocytes, especially mononuclears.
(*c*) The habituation of the trypanosomes to their antibodies.
(*d*) The absence or the diminution of antibodies to the trypanosomes.*

8. The decrease of trypanosomes is due to their rapid death and to a cessation of multiplication, probably depending on the following conditions :—

(*a*) The presence of antibodies in the serum;
(*b*) The large increase of leucocytes, especially mononuclears.

The details of these conclusions are contained in the following publications :—

" A Case of Sleeping Sickness, studied by Precise Enumerative Methods, periodic cycle in the number of trypanosomes disclosed." Ross and Thomson. " Annals of Trop. Med. and Parasit," Vol. IV., No. 2, July, 1910.

" A Case of Sleeping Sickness, studied by Precise Enumerative Methods, Further Observations." Ross and Thomson. " Proc. Roy. Soc. B.," Vol. LXXXIII., p. 187.

C.—Minor Researches on a Case of Blackwater Fever and a Case of Leprosy.

The case of blackwater fever showed very clearly the initial malarial infection and the administration of quinine followed by fever and hæmoglobinuria. No parasites could be detected in many thick films during the hæmoglobinuria, and, later, a peculiar relapse took place in which there were no hæmoglobinuria and no detectable parasites.†

Publications.

" A case of Blackwater Fever followed by a Peculiar Relapse without Hæmoglobinuria or Detectable Plasmodia." Ross, Thomson, and Simpson. " Annals of Trop. Med.," Vol. IV., No. 3, Dec., 1910.

The case of leprosy was of the maculo-anæsthetic type, and a patch under which nastin was injected showed very marked improvement. The other patches were not much influenced, showing that the beneficial effects of the injections were more local than general. Results of this research are not yet published.

I am, &c.,
Professor Sir Ronald Ross, K.C.B., F.R.S. DAVID THOMSON.

II.

Johnston Tropical Laboratory, University of Liverpool,
10th October, 1911.

SIR,

In January, 1910, I was appointed Pathological Chemist to the Liverpool School of Tropical Medicine, with funds allotted to the school by the Advisory Com-

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* See also Dr. Fantham's report (following) on the rounded forms.
† See also the following report by Dr. Simpson.

mittee for the Tropical Diseases Research Fund (Colonial Office), and have since then been engaged in the investigation of various chemical problems connected with the causation, pathology, and treatment of tropical diseases in the Chemical Department of the School of Tropical Medicine, in the Tropical Ward of the Royal Southern Hospital, and in the Bio-Chemical Department of the University.

I submit a report on the main investigations carried out from January, 1910, till the termination of the grant in June, 1911.

I. *Hæmoglobin metabolism in malaria.*

During the first part of the period, the time was mainly devoted to a consideration of the blood metabolism in malarial fever, with a view to the determination of the connection between malaria and blackwater fever, though other short investigations were also made on the elimination of quinine from the body, the urine of malaria, &c.

After some preliminary work and a consideration of the results of previous workers, more especially of the report of the Blackwater Fever Expedition of this School, I resolved primarily to devote my attention to the excretion of the remote products of hæmoglobin breakdown in malarial patients.

The most important of these is urobilin, and a satisfactory quantitative method of determining this in urine was first found; the application of this method to the malarial patients in the Tropical Ward yielded striking results. Every attack of fever caused an increase in the urinary urobilin, which varied to some extent with the severity of the attack. The quantity of urobilin excreted in some cases was very large compared to recorded figures for other diseases.

The total output was however far less than the total loss of hæmoglobin from the circulation would account for, and as urinary urobilin is considered to arise from the alimentary canal, attention was, after a time, directed to the fæces.

When a satisfactory clinical method of estimating the urobilin in this was discovered, it at once appeared that, not only in malarial fever but in other conditions, the excretion of urobilin by the bowel is very much larger in amount and more regular than by the urine.

A series of cases of malaria were studied, and it was found that a large amount of blood pigment is broken down in a paroxysm of malaria and excreted from the body. Comparison of my results with Dr. Thomson's figures* for the same cases showed, however, that the amount of hæmolysis does not correspond closely to the degree of fever present or to the number of parasites in the blood, though it is to some extent related to the severity of the attack. The virulence of the infection and the resistance of the patient play a part in the degree of hæmolysis.

The results showed that in malarial fever there is increased excretion of altered blood pigment through the natural channels after each paroxysm of fever, the amount varying from about 4 per cent. of the total blood in simple tertian malaria to 10 per cent. in mild infections with the malignant tertian parasite and rising as high as 25 per cent. of the total blood in severe attacks of the malignant variety.

II. *Hæmoglobin metabolism in blackwater fever.*

In a case of blackwater fever it was found that the direct excretion of hæmoglobin by the urine was totally inappreciable in comparison with the enormous breakdown of blood pigment which took place in the body; while the hæmoglobin of one-half per cent. of the total blood was excreted unchanged in the urine, the normal channels of excretion dealt with nearly one hundred per cent. of the circulating pigment.

Disturbance of the liver or other organs concerned in the elimination of blood pigment could not therefore have played a part in this case of blackwater fever, though it may do so in some cases. The organs were working remarkably well and only a small amount of hæmoglobin escaped the normal fate and passed out unaltered through the kidney. As far as the eliminating organs are concerned, blackwater fever resembles malaria; in both diseases a large amount of blood pigment is metabolised, but in blackwater the amount to be dealt with is so large that part overflows unaltered through the renal epithelium before it can be dealt with by normal channels. These results were published in the papers mentioned

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* See the previous report by Dr. Thomson.

in the Appendix, and further reseaches have been carried out on the problems arising out of this work and will be embodied in future papers. Other cases of blackwater fever have been under observation but various factors have rendered the results inconclusive.

The blood of malarial patients at various stages of the disease has been examined for hæmolytic action and positive results have been obtained. These appear to prove, as already expected, that at some stages of the attack a hæmolytic substance is present in the serum of malarial patients, though only in about ten per cent. was a positive result obtained. The most favourable time to obtain hæmolysis would appear to be in the premonitory shivering before pyrexia occurs, and the best marked results have been obtained in cases of simple tertian infection. Further investigations are being made, but it is necessary also to determine the influence of the acquired immunity of the patients, and it is hoped that research bearing on fixation of complement may give results, as has been so fruitful in syphilis (Wassermann reaction).

The problems connected with the excretion of blood pigment have been followed out in a series of researches on animals. By a graduation of dosage (and a choice of animals) it is possible to produce either jaundice, large excretion of urobilin, or hæmoglobinuria by injections of Toluenediamine (*v.* Afanaffiew and others); and we have been carrying on investigations on various drugs on these lines with particular reference to urobilin excretions—this substance is, however, less important a product of hæmoglobin metabolism in animals than in man, and in herbivora the results were very disappointing.

The average daily excretion of urobilin by the animal was first noted and the increase noted after the intraperitoneal injection of measured amounts of hæmoglobin.

Various hæmolytic drugs were then injected and the increased excretion of urobilin noted, and by comparing these with the results of the previous experiments a measure of the hæmoglobin metabolism was obtained. The special interest lay in the fact that the injection of quinine and of certain of its derivatives led to an increase of urobilin, though quinine is not regarded as a hæmolytic drug, nor does it exercise any hæmolytic effect in vitro except in high concentrations; small as these increases were, they yet show that quinine is hæmolytic to some extent in the body, and are of special interest in view of the known relationship of blackwater fever and quinine.

An attempt has been made to discover if a similar effect resulted from the administration of quinine in heavy doses in man; the experiment, however, is impossible or inconclusive as a rule in hospital patients, owing to urobilin excretion being altered by many diseases, and other factors. Similarly, only a few experiments involving the administration of large doses of quinine could be carried out on ourselves since they involved at least partial cessation of other work and any temporary indisposition again vitiates the result. The results, however, render it probable that quinine in man, as in animals, leads to hæmoglobin breakdown, showing itself by increased urobilin excretion. Graham has recently published a paper which confirms these results.

The results of these two sets of experiments show that a hæmolytic substance is liberated at some period of the attack, and that administration of quinine also leads to hæmolysis. The summation of these two factors, and possibly of others, may play some part in the causation of blackwater fever, and it is interesting to note that De Jonge, in Batavia, found larger average excretions of urobilin in the urine of malaria than I obtained, and that my results were obtained in cases untreated with quinine while his were obtained after administration of this drug. The hæmolytic action of the blood serum appears more localised to the beginning of the paroxysm in simple tertian than in malignant malaria, and he obtained his highest excretion of urobilin (urinary) in simple tertian cases treated with quinine, while my highest outputs (urinary and fæcal) were in cases of malignant infections without treatment with quinine (blackwater fever being excluded).

In conjunction with these experiments Dr. Thomson has been investigating the therapeutic value in malaria of several of the chemical relatives of quinine (especially more hæmolytic drugs), and pending the conclusion of his work, our researches were suspended in favour of other investigations.

III. Beri-beri.

Towards the end of 1910 the Chemical Department of this school was strengthened by the addition of Mr. Edie, and had for the time its own laboratory with a

fair equipment for research. The Professor called our attention to recent work on beri-beri, and asked us whether further work on the bio-chemistry of this disease would not be of value. After a consideration of the literature, especially the work of Braddon and others, which connected its occurrence with the use of certain food-stuffs, and of Eijkman and Grijns, who showed that the same foodstuffs caused a similar neuritis in animals and birds, we proceeded to confirm the results of these experimenters and commenced investigations to determine if the results were due to deficiency of fat in the foods in question.

Before we had proceeded far with this work, a monograph appeared on the subject by Dr. Schaumann, Chemist to the School of Tropical Medicine in Hamburg, and this was so important and far reaching that we had to reconsider our position.

Schaumann had carried the problem much further than previous workers (though Fraser and Stanton have also obtained results on somewhat similar lines), and we first of all carried on a large number of confirmatory experiments on animals and analyses, and our results were in full agreement with his statements. We published a preliminary note in the "British Medical Journal" in June, and a longer account in the "Annals of Tropical Medicine" in July, 1911.

Tropical beri-beri, ship beri-beri, scurvy, and possibly pellagra and other diseases appear to depend on a restriction of diet, not in quantity but in quality, and the results of investigations into these diseases appear likely to revolutionise the present ideas of the bio-chemistry of diet. A diet of protein, carbohydrate, and fat with addition of water and mineral salts was considered sufficient to maintain life and health if sufficient in energy (caloric value), and the carbohydrate and fat could be dispensed with if sufficient proteid were given instead. Recent investigations, however, seem to show that though these substances are sufficient for the bulk of the requirements, yet small amounts of other substances are necessary to maintain fully the working of the animal mechanism, and these substances are in large measure contained in special parts of vegetable foodstuffs from which they may be and are removed by modern milling of the grains. They are also present in flesh-foods, but they are very unstable and their value is easily destroyed by strong heating or chemical means, and so are, to a large extent, deficient in pickled meat and in foods sterilised by heat for preservation. This loss matters little so long as fresh vegetables and meat or other luxuries are also comprised in the diet, but if the diet becomes deprived of such luxuries, either through a rise in the price of the staple diet through famine, or through financial trouble in the family, or through the lack of opportunity to replenish the stock of luxuries, as in ships on long voyages, the absence from the residue of these essential principles leads to disease or even death. The nature of these essential substances is as yet unknown, but they appear to consist of, or to associate with, certain groups of organic compounds of phosphorus. They are highly unstable and readily modified by even mild chemical reagents, and so lose their physiological activity during the process of isolation.

We are endeavouring to isolate these substances, and for this purpose have been carrying on joint analytical and feeding experiments, but the problem is long and difficult, and the lines which appear to hold out promise of success may yet prove negative. Partial success rewarded our work with lecithein and with casein.

The subject appears to be of far reaching importance not only to the labourers in the colonies and dependencies of this country, who often suffer from beri-beri or scurvy owing to restricted and faulty diet, and to our mercantile marine, where similar factors are so often encountered, but also possibly to our own working class population, whose physique may be suffering from similar manipulations of their foodstuffs. If the essential substances can be isolated and preserved a rapid means of treating the diseases, caused by its absence, can be kept ready for use on ships or in other places where these outbreaks occur, meanwhile it is possible to minimise the damage by careful supervision of the food supply, as is now being done in the great public institutions of India, to prevent beri-beri (from the use of too highly milled a rice), and by supervision of the stores carried by the mercantile marine. In the recent paper an outbreak of beri-beri on an English steamer was attributed to the fact that the native lascars could only obtain the highly ground and prepared "English rice" in our home ports, to replenish the stock of cured rice they had brought from the East, though careful search was made for the less polished "Calcutta rice" they were accustomed to get, and which they knew would not lead to the outbreak of beri-beri.

Finally we have been investigating the problem of pellagra and of phagopyrism, which some consider as a factor in that disease. We have been unable to produce,

even in this hot summer, the lesions said to occur in albino animals exposed to the sun and fed on maize, and we felt that though sunlight and lack of pigment may play some part in pellagra, yet the variety of the maize used may be the important factor. We intend next summer to make further experiments to see if this result can be obtained with maize meal, which differs from whole maize in the same way that polished rice differs from rice grain in its power of producing neuritis. It is possible that the lesions described are due to the irritation produced by direct sunlight on skin, which has suffered trophic changes from peripheral neuritis, developed on a maize meal diet.

We hope to publish further papers on the results of our experiments with particular reference to:—

(1) The presence of hæmolytic substances in malarial serum.
(2) The hæmolytic action of quinine in animals and man.
(3) The active organic phosphorus compounds of diet in relation to diseases of metabolism, especially beri-beri.
(4) The possible influence of prepared maize as a factor in pellagra.

We are anxious to extend our researches into these problems and also to study the question of acquired immunity in malaria by further work on the serum of malarial patients.

I have, &c.,
George C. E. Simpson.

To Professor Sir Ronald Ross, K.C.B., F.R.S.

Appendix.

Publications.

On hæmoglobin metabolism in malarial fever. (Preliminary note.) "Proceedings of the Royal Society," B., Vol. 83, 1910.

On hæmoglobin metabolism in malarial fever. "Annals of Tropical Medicine and Parasitology," Vol. IV., No. 3, December, 1910.

A case of blackwater fever followed by a peculiar relapse without hæmoglobinuria or detectable plasmodia. (In conjunction with Professor Ross and Dr. Thomson.) "Annals of Tropical Medicine and Parasitology," Vol. IV., No. 3, December, 1910.

On the quantitative estimation of urobilin in the excreta, and its value as a measure of hæmoglobin metabolism. "Bio-Chemical Journal," Vol. V., Nos. 8 and 9, 1911.

On the influence of preparation on various foodstuffs, particularly rice and wheat, and its connection with disease. (In conjunction with E. S. Edie.) "British Medical Journal," June 17, 1911.

On the relation of the organic phosphorus content of various diets to diseases of nutrition, particularly beri-beri. (In conjunction with E. S. Edie.) "Annals of Tropical Medicine and Parasitology," Vol. V., No. 2, August, 1911.

III.

Johnston Tropical Laboratory,
University of Liverpool, 17th October, 1911.

Sir,

I beg to submit an account of the researches conducted by me during the fourteen months ending June, 1911, while working in the Liverpool School of Tropical Medicine with funds allotted by the Tropical Diseases Research Committee of the Colonial Office. Also I add a short account of subsequent researches to date.

Owing to the few cases of amœbic dysentery seeking admission to the Royal Southern Hospital, Liverpool, during the period, I did not spend all my time on researches on Amœbæ parasitic in the human digestive tract—for which researches the grant had been made—though I was able to make a careful study of cultures of *Amœba coli.* When I began work in Liverpool, there was a case of sleeping sickness contracted in Rhodesia in your clinic, and in rats inoculated with the trypanosome obtained from this case Dr. Stephens had just found a morphological peculiarity

which needed very careful and extended research, while you, Sir, and Dr. D Thomson were finding a periodic or cyclical variation in the number of the parasites occurring in the peripheral blood of the patient from day to day. It was, then, deemed advisable for me to devote immediate attention to the trypanosome occurring in the case of sleeping sickness from Rhodesia, especially as the patient had never been in a district in which *Glossina palpalis* occurred. Accordingly, I commenced researches on the trypanosome in sub-inoculated animals—rats, guinea-pigs, and rabbits—for the patient died at the end of June, 1910.

Enumerative studies of the trypanosome were undertaken, using new methods, namely, measured quantities of the peripheral blood of the host were taken, one cubic millimetre in volume, in carefully graduated pipettes, the graduations reading to quarters of a cubic millimetre, as used by R. Ross and D. Thomson. Drops of freshly drawn blood, each one-quarter of a millimetre in volume, were rapidly and evenly spread with a needle into the form of a square of about 4 mm. side. When dried, these squares of blood were dehæmoglobinised, fixed in absolute alcohol, and stained after the Romanowsky method. With practice one soon learned to spread these quarter cubic millimetres of blood evenly and to dehæmoglobinise them without losing any of the contained parasites. The blood so treated was examined under an oil-immersion objective, using an Ehrlich eye-piece. By this means parasites could be detected in the blood when too few in number to be found by the aid of ordinary blood-smears, and so more exact determinations of the incubation period of the trypanosome in sub-inoculated animals were obtained. When the parasites were very numerous, several strips across the quarter cubic millimetre (spread in the shape of a square) were examined and the trypanosomes therein counted and averaged. This method was used by R. Ross and D. Thomson in their examination of the blood of the patient as well as in the examination of blood containing malarial parasites, and the relative accuracy of the method is discussed by them.

Two strains of trypanosomes were examined daily, namely, the Rhodesian strain already mentioned and now named *T. rhodesiense* (Stephens and Fantham, 1910), and a virulent strain of *T. gambiense* for comparison. Enumerations were made at the same time by Mr. J. G. Thomson in connection with his researches on cryotherapy, and we subsequently collaborated in a paper read before the Royal Society on December 8, 1910. In this paper were tabulated our daily counts of over forty animals, showing the incubation periods and duration of life during infection of animals inoculated with either *T. rhodesiense* or *T. gambiense.* From these results, and from graphs based on them, we were able to deduce a periodic cyclical variation in the numbers of the parasites in the peripheral blood of rats, guinea-pigs, and rabbits, comparable to the cycle found by R. Ross and D. Thomson in man, and also to infer that the Rhodesian strain was even more virulent than the strain of *T. gambiense* used for comparison. The periodic variation or oscillation in sub-inoculated animals was in some cases not quite so regular as in the case of man, probably because the animals used were not the natural hosts of human trypanosomes and their resistance tended to vary somewhat irregularly.

Experiments on larger animals inoculated with *T. rhodesiense*, conducted by Dr. Warrington Yorke at Runcorn, confirmed the extraordinary virulence of *T. rhodesiense* over strains of *T. gambiense.*

During these enumerative experiments, I examined smears of the organs of animals dying of trypanosomiasis and also killed animals at varying periods of infection, ultimately examining a series of animals at all periods of the cycle revealed by the counts of the parasites in measured quantities of peripheral blood daily. I found that during the depressions in the curve representing the numerical or enumerative cycle there was also what may, for convenience, be termed a morphological cycle. Rounded, non-flagellate or latent forms of trypanosomes begin to be formed about the time indicated by the crests of the enumerative wave. Their process of formation takes time, so that during the period of depressions or troughs in the curve rounded forms of the parasite are found in the internal organs of the host. I ascertained that the formation of such rounded parasites took place more especially in the lungs and that they tended to collect in the spleen and bone-marrow.

Rounded or latent bodies of trypanosomes were first described as such by Moore and Breinl in 1907, using stained preparations, but their experiments did not include precise enumerations of the parasites. Rounded forms of trypanosomes occur in the internal organs of the host when the flagellate parasites may even be

absent from the peripheral blood, as may happen when dealing with less virulent strains. On the few occasions when rounded forms of trypanosomes had been recorded previously to 1907, they were usually termed " involution " or " degenerate " forms. Why they should be considered as " degeneration " forms I fail to understand, unless it was because the observers did not trouble to follow their formation and subsequent evolution. They do not show the usual signs of morphological degeneration, such as vacuolation or chromatolysis or irregularity of form; and sometimes they can be seen in the peripheral circulation of the host as rounded uniflagellate forms actively moving about. I studied actual degenerating forms of trypanosomes and figured them in my paper published by the Royal Society in January last. However, I endeavoured to prove experimentally that rounded forms were not degeneration products, but that these rounded, latent bodies actually had a part in a life-cycle of the trypanosome in vertebrate blood. I had previously seen, after long and earnest searching in freshly drawn, warm, infected blood that rounded bodies endeavour to flagellate; and, on a few occasions, when apparently natural conditions—so difficult to imitate—were approximately maintained, or, when freshly drawn, warm, uninfected blood was added to rounded bodies, that actual flagellate trypanosomes were produced. In the flagellation of rounded bodies *Crithidia*-like stages are passed through. Accordingly, rounded bodies, obtained from infected spleen-pulp, were inoculated into a rat, and subsequently the animal died of trypanosomiasis after a somewhat delayed period of incubation and lengthened period of infection. Every endeavour possible was made to exclude the inoculation of flagellate trypanosomes and to ensure that only rounded bodies were used, for in one case I tried the difficult experiment of the inoculation into a rat of one cubic millimetre of infected spleen pulp (containing rounded bodies) which had been previously examined microscopically and no flagellates found therein. Full details of the counts and distribution of the trypanosomes in the various internal organs are given in my paper already noted and reference to which will be found at the end of this report. There is some evidence that the latent bodies may divide into two in the lungs soon after they are formed. I concluded that latent bodies are non-flagellate, relatively resistant forms of trypanosomes found in the internal organs during periods when the flagellate parasites are few or absent from the peripheral blood of the host, and that such rounded forms are produced by the mutual action and reaction of the host and the parasite. It may be that this cycle of trypanosomes in vertebrates is, as it were, still in the making, and is what you, Sir, have called a conditional cycle, since the periodicity appears to vary with the resistance of the host and in different hosts, in contrast with the fixed periodicity and unconditional cycle of, say, the malarial parasite. The subject is a most difficult one and examination of sections of infected organs is now in progress.

With Dr. Stephens I studied the morphology of the trypanosome from the case of Rhodesian sleeping sickness. In smears from the blood of many different sub-inoculated animals—namely, rats, guinea-pigs, rabbits, dogs, horses, monkeys—stout or stumpy forms of trypanosomes with the nucleus posterior and close to the blepharoplast (kinetic nucleus) could be found. The actual posteriority of the nucleus varied from forms with the nucleus (trophic nucleus of some authors) just anterior to the blepharoplast, others with the nucleus at the side of the blepharoplast, and others, again, with it quite posterior to the blepharoplast. This morphological peculiarity (found in 6 per cent. of the trypanosomes), together with the fact that the patient was never bitten by *Glossina palpalis* and also the extraordinary virulence justify the regarding of this parasite as a new species (*T. rhodesiense*).

Following a suggestion made by Sir David Bruce, Dr. Stephens and I have been conducting what may be termed a biometric study of this parasite. We have carefully outlined (by the use of projection apparatus) and measured (by use of the " tangent-line " method) over one thousand specimens of *T. rhodesiense.* The length of the median longitudinal axis of the parasite is thus determined. We have measured specimens of the parasite from every day of infection in rats, as well as from man and other sub-inoculated hosts. Plotting percentage of infection and length of trypanosomes, we have constructed a curve comparable to those obtained by Sir David Bruce and his colleagues for various other trypanosomes. Our attention has been especially given to this biometric study since June last and we hope to publish our results shortly. Already we have deduced a curve or graph which is different from that obtained by Bruce for *T. gambiense* and supports the view that

T. rhodesiense is a distinct species. Furthermore, it may be mentioned that cross-immunity experiments on our strain of *T. rhodesiense* recently published by Professor Mesnil also show that it is distinct from *T. gambiense*. However, further details will be published later. A trypanosome having the morphological characters of *T. rhodesiense* has been recorded by Stannus and Yorke in animals sub-inoculated from a case of sleeping sickness contracted in Nyasaland.

Before leaving the subject of *T. rhodesiense*, I should like to add that I tried the effect of arsenophenylglycine on the parasite in rats. A few experiments were also made with atoxyl, and atoxyl was used by Mr. J. G. Thomson, who has already published his results. In my own experiments I found that *T. rhodesiense* was remarkably resistant to arsenophenylglycine as well as to atoxyl. Although the flagellate trypanosomes in the peripheral blood of the host were killed by arsenic-containing drugs, some chromatolysis first resulting, yet rounded drug-resistant forms of the trypanosomes were produced, and could be found in the internal organs after death, and I found that the natural latent bodies of the parasite were also drug-resistant, that is, more resistant than the flagellate forms. Of the eight experimental animals treated with arsenophenylglycine all relapsed and subsequently died, even though a further treatment with the drug was given after the first relapse. In the patient, R. Ross and D. Thomson found the trypanosome resistant to atoxyl.

Regarding my researches on Amœbæ, I examined and studied cultures of *Amœba coli* on Musgrave and Clegg's medium, and saw the complete life-cycle therein, both schizogonous and sporogonous. The amœbæ studied came originally from dysenteric cases in Manila. When fed to kittens or injected into them per rectum, the amœbæ were found to be non-pathogenic. The spore formation was characterised by cysts containing eight daughter amœbæ, and as the general morphology agreed with that described for *Amœba coli*, I think there is no doubt that the cultures I was dealing with were those of *Amœba* (*Entamœba*) *coli*. In a paper published in April in the "Annals of Tropical Medicine and Parasitology," I described the life-cycle of this amœba in cultures. The cycle is passed through in about four days in the cultures, when all the amœbæ encyst and remain in that condition. The cultures were renewed every fortnight to three weeks. I also examined stools of patients admitted to the Royal Southern Hospital, Liverpool, and said to be suffering from dysentery. Very few of these cases showed amœbæ in any form in the stools, even after prolonged examination. However, one case from Nigeria proved interesting, as I was able to study one day *Entamœba tetragena*, one of the causative parasites of amœbic dysentery. But the case was an old one, the material was scanty, and attempts at culturing the parasite proved abortive, as did experiments on kittens—probably chiefly because of the paucity of material. But stools of this patient were examined for three months after treatment, and an occasional amœba or encysted amœba could be found at the end of that period. During my researches I endeavoured to find fresh substances suitable for culture-media for amœbæ. I thought it would be well to try the effects of substances occurring naturally in the human intestine or fæces and accordingly experimented with tyrosin, leucin and skatol, among others. Both tyrosin and leucin when added to alkaline agar media formed suitable cultures for *Amœba coli*, in which remarkable results were obtained. On a tyrosin-containing medium it was found that the amœba passed through its complete life-cycle, and then began it afresh and continued this process. I was able to obtain five generations of amœbæ on the culture—in other words, five generations of cysts of amœbæ were produced in about 15 days, when the process apparently stopped. This phenomenon was demonstrated to co-workers in the laboratory. The "growth," however, did not appear to increase much, certain of the amœbæ dying while others multiplied. Similar results occurred with a leucin-containing medium; skatol, on the other hand, hastened encystation of *Amœba coli*. Tyrosin and leucin possibly induce division, which was also found by Dr. H. C. Ross and Dr. Cropper, who term these substances "auxetics." The experiments are further described in my paper.

The problem of the elucidation of amœbic dysentery is most complex and difficult. The results obtained during the last twenty years are most conflicting. I studied the principal papers written during that period, and at the suggestion of you, Sir, summarised our knowledge of the ten amœbæ, at present stated to be parasitic in the human intestine, in my paper already mentioned. As remarked, the subject is most difficult, for some of the amœbæ which may be found in the human intestine are apparently harmless, others are apparently pathogenic. In

feeding experiments on animals we have to guard against amœbæ which may be already present in the animals' digestive tract, or the animal (for example, a monkey) may be already suffering from an incipient attack of dysentery practically unrecognisable. The culturing of amœbæ, again, may be most illusory, amœbæ may occur naturally in drinking water and amœba spores apparently occur in the air, so that one must be on guard when endeavouring to culture amœbæ from stools, and try to be sure that one is really growing an amœba derived from the stools, and not some accidental or elusive contaminative amœba. These parasites exhibit polymorphism, and polymorphic forms may be thought to belong to more than one species, so that further researches on the difficult subject of amœbic dysentery are most urgently needed.

Before concluding, I should like briefly to record an interesting parasite which I found some years ago, when working in Cambridge. It is a flagellate, belonging to the genus *Herpetomonas*, occurring in the gut of the human body-louse, *Pediculus vestimenti*. At the time that I first found it, there seemed to be no special reason for recording the presence of yet another *Herpetomonas*. Lately, however, it has been suggested that flagellates like *Herpetomonas* and *Crithidia* occurring in the guts of blood-sucking insects are really stages of some vertebrate trypanosome. Controversy has arisen concerning this general statement, but I have no wish to enter into controversy. In consequence of the importance of the subject in its relation to the transmission of trypanosomes, I have resumed my study of the flagellate which I found in the digestive tract of the body-louse, a parasite which I propose to call *Herpetomonas pediculi*. The flagellate is rare; I have dissected as many as fifty lice at one time without finding a *Herpetomonas*. I have conducted breeding experiments with lice and have found the parasite in bred lice. These lice must have obtained the cysts of the *Herpetomonas* from the fæces of their neighbours, and by swallowing the cysts infected themselves. The lice used in breeding experiments have been kept alive by feeding on my own blood, and have been kept warm, in a small tube containing a bit of clothing-material, by the warmth of my own body. So far, examination of my blood, after allowing lice infected with *Herpetomonas* to feed on it, has proved negative for trypanosomes, whether the examination of the blood were by smears, by thick films or by cultures (using the Novy-MacNeal-Mathis medium). On present evidence I can only conclude that *Herpetomonas pediculi* is a natural parasite of the louse, and not a developmental stage of a trypanosome; nor is it connected with Leishmania.

I append a list of my published papers during the period mentioned in this report.

I am, &c.,
H. B. Fantham.

To Professor Sir Ronald Ross, K.C.B., F.R.S.

References to Published Papers.

Fantham, H. B. (1911), " The life history of *Trypanosoma gambiense* and *Tryp. rhodesiense*, as seen in Rats and Guinea-pigs." " Proc. Roy. Soc.," B 83, pp. 212-227, 1 plate.

Fantham, H. B., and Thomson, J. G. (1911), " Enumerative Studies on *Trypanosoma gambiense* and *Tryp. rhodesiense* in Rats, Guinea-pigs and Rabbits; periodic variations disclosed." Preliminary Note in " Proc. Roy. Soc.," B 83, pp. 206-211, 5 charts. Full paper in " Ann. Trop. Med. and Parasitol," IV., pp. 417-463, 8 charts.

Fantham, H. B. (1911), " On the Amœbæ parasitic in the Human Intestine, with Remarks on the Life-cycle of *Entamœba coli* in Cultures." " Ann. Trop. Med. and Parasit.," V., pp. 111-123.

Stephens, J. W. W., and Fantham, H. B. (1910), " On the Peculiar Morphology of a Trypanosome from a Case of Sleeping Sickness, and the possibility of its being a New Species (*T. rhodesiense*)." " Proc. Roy. Soc., B 83, pp. 28-33, 1 plate.

APPENDIX VI.

Reports on Work done in Colonial Laboratories.

No. 1.

BASUTOLAND.

EXTRACT FROM THE REPORT OF THE PRINCIPAL MEDICAL OFFICER FOR 1910.

(Received 24 June, 1911.)

A NOTE ON THE TRANSMISSION OF LEPROSY.

The means by which the leprosy bacillus is introduced into the human body have not yet been definitely established.

Commensal feeding, direct inoculation, or contagion have been generally accepted as being the most likely methods of introduction, but no proof of either of these methods has yet been adduced, and I believe the leprosy bacillus has hitherto not been found outside the human body.

The fact that leprosy is most common among people of unclean personal habits, and living in unhygienic surroundings, points to some co-existing source of contagion.

The possibility of the bacillus being carried by vermin occurred to the writer. With a view to testing this hypothesis bed bugs, obtained from huts which had never been inhabited by lepers, were caused to bite lepers in the neighbourhood of leprous nodules on the face. The bugs were then killed, and the alimentary tract and its contents examined. In every bug that bit freely a bacillus was found which in shape, size, and staining reactions is similar to the *bacillus lepræ.*

Control bugs from the same hut gave in every instance a negative result.

The experiments are still in progress, and it is intended, as soon as circumstances permit, to solve the following questions :—

(1) How long the bacilli remain in the bug's body.
(2) If bugs which over a period of weeks have fed on the blood from leprous nodules present any evidence of growth of bacilli in their tissues.
(3) What organs of the bug contain bacilli.
(4) Whether any other vermin, *e.g.*, fleas and lice, contain bacilli.

These experiments are only regarded as preliminary to a thorough investigation of the subject, but the question is so important that I have ventured to record my results in the hope that other observers may be induced to experiment on the same lines. I think it will be found that lepers may be inoculated by infected bugs, and this point can be elicited by causing infected bugs to bite lepers on parts of the skin on which there are no leprous lesions.

If my hypothesis is correct a great many facts regarding the spread of leprosy which have hitherto been inexplicable would be made clear.

Inquiries into the past history of certain lepers go to show that they could only have become infected with leprosy through some intermediate host.

The fact that plague is carried by fleas warrants, at any rate, the inference that leprosy may possibly be carried by bugs. Further, the fact that only a percentage of human beings are attacked by the bed bug, or for the matter of that, by the flea, would serve to explain why it is that only some of those people who live in close association with lepers become lepers also.

All lepers that I have questioned admit that bugs bite them freely, and it is not unreasonable to assume that such a voracious feeder as the common bug must, in the course of his nightly meal, ingest a considerable number of leprosy bacilli if his bites were in the neighbourhood of leprous nodules, which are often swarming with the *bacilli lepræ.* If such infected bugs were to bite a non-leper there would be a good chance of the bacillus being introduced into his system.

The following history of a recent case of leprosy is only explicable by assuming some method of infection as suggested above.

A native, X., residing in a village about three miles from Maseru, presented himself as an out-patient about three months ago with some well-marked tubercular leprous patches on the face. They had appeared about six weeks previously. There are no lepers in his village, and none of his relatives are lepers. Inquiries as to how he had spent his time, and where he had been during the preceding year, elicited the fact that he had during that period visited on three or four occasions a village

about fifty miles away, where there was one leper, who was, however, driven from the village during the period in question. X. had been in the leper's hut, but had never partaken of food there. After the leper had been driven away X. spent one night in the hut, and was severely bitten by bugs there.

The closest questioning failed to elicit any further evidence of contact with lepers or their dwellings, and one is almost forced to the conclusion that X. was inoculated by leprosy-infected bugs or other parasites on the one night he spent in the infected hut.

EDW. C. LONG,
Principal Medical Officer.

No. 2.

BRITISH GUIANA.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received 28 July, 1911.)

Government House, Georgetown, Demerara,
29 June, 1911.

SIR,

I HAVE the honour to transmit, in duplicate, a report by Dr. E. P. Minett, Acting Government Bacteriologist, on tropical diseases research work done in the British Guiana laboratory during the half-year ended the 30th September, 1910. I regret that this report has not been sent at an earlier date, but the Surgeon-General informs me that nearly the whole of the time of the Government Bacteriologist, prior to his proceeding on leave of absence last October, has been taken up in the important work of investigating the treatment of leprosy, with regard to which a report has been sent to you, and that the Assistant Government Bacteriologist has had his time more than fully occupied with the general bacteriological work of the Colony.

2. I am advised that it will not be possible to submit a report in respect of the half-year ended the 31st March last, for the following reasons :—

(*a*) The absence of the Government Bacteriologist.
(*b*) The large increase in the ordinary work of the laboratory.
(*c*) The further investigations of the Assistant Bacteriologist in the treatment of leprosy.
(*d*) The compilation of a mosquito census of the city of Georgetown by the Assistant Bacteriologist.

3. Reference is made in the report now forwarded to the publication in the British Guiana Medical Annual, 1910, of particulars of certain cases of anthrax in British Guiana. Printed copies of the Medical Annual have not as yet reached the Colony, but I will forward two copies to you as soon as they come to hand.

I have, &c.,
F. M. HODGSON.

Enclosure in No. 2.

Government Bacteriological Department, Georgetown,
19th May, 1911.

SIR,

I HAVE the honour to enclose herewith reports on research work carried out in this laboratory from 1st April, 1910, to 30th September, 1910, in connection with the Tropical Diseases Research Fund.

Owing to the illness of my colleague, Dr. Wise, and the fact that the number of routine specimens sent to this Department for examination is practically double that of 1909, this work is rather of an intermittent nature, and carried out under very adverse conditions. It would have been impossible without the assistance of Dr. Duncan, who kindly placed his spare time at my disposal for the work.

I have, &c.,
E. P. MINETT,
Acting Government Bacteriologist.

The Honourable
The Surgeon-General,
Georgetown.

A consignment of various snakes, birds, lizards, and flies were sent to the London School of Tropical Medicine for identification.

A selection of various malarial, ankylostome, and leprosy organs were also sent for teaching purposes.

A cestode, believed to be a new species, was found in a bird's intestine, and sent to Dr. Leiper for identification.

A large number of slides of birds' blood containing halteridia and prateosoma were prepared and sent to Dr. Newham for use for teaching purposes.

Two fatal cases of anthrax were investigated, bodies coming to the post-mortem room.

The anthrax bacillus was recovered from pure culture, and identified fully; in one case the lesion was a pulmonary one, and the other a cutaneous affection. A full report of these cases appear in the British Guiana Medical Annual, 1910.

A full bacteriological examination of 52 samples of milk was carried out with a view to investigating the purity of the supply of this city. This is reported fully in the Surgeon-General's Annual Report, 1910.

An attempt was made to work out some of the unclassified fevers in this Colony, but owing to illness of my colleague, Dr. Wise, this could not be followed up fully. I enclose provisional report.

The results of the Nastin and modified Nastin treatment carried out at the Leper Asylum during the period are embodied in Dr. Wise's report.

E. P. Minett,
Acting Government Bacteriologist.

Unclassified Fevers.

An attempt was made at various times from March, 1910, to September, 1910, to identify some cases of the above.

Cases admitted to estates hospitals suffering from pyrexia were placed under observation immediately on admission. Quinine was withheld, an aperient only being given.

A blood examination was carried out immediately on admission, together with a search for malaria parasites, and a Widal's agglutination reaction carried out in order to definitely exclude typhoid and malarial fevers if possible.

In all 60 cases were investigated at various estates hospitals, principally at Enmore and La Bonne Intention with a few from Suddie. Twenty cases were treated in a similar manner chosen from amongst the admissions to the Public Hospital, Georgetown, these observations were carried out by Dr. Duncan.

Of the above 80 cases, in five cases malaria parasites of the sub-tertian variety were detected; these cases were rejected.

The general findings and conclusions were as follows :—

(*a*) The red corpuscles were distinctly low, the highest count being 4,400,000, and the average being 3,000,000 per cubic mm.

(*b*) The white corpuscles averaged 6,500 per cubic mm.

(*c*) The polymorphonuclear leucocytes averaged 49 per cent.
Large lymphocytes averaged 12·1 per cent.
Small lymphocytes averaged 26·4 per cent.
Hyaline cells averaged 3·2 per cent.
Eosinophile averaged 10·3 per cent.
Basophile averaged ·3 per cent.

(*d*) The hæmaglobin index averaged 60 per cent.

Owing to the illness of my colleague, Dr. Wise, we were unable to follow up this investigation further, but the following provisional conclusions were arrived at :—

(1) That many cases of pyrexia admitted to hospital are not truly malarial, inasmuch as no sporulating parasites can be detected in the peripheral blood.

(2) And we are of the opinion that they are cases of true siriasis or heat exhaustion.

(3) But we are strongly of the opinion that these cases of exhaustion result from the anæmia caused by repeated malarial attacks, and that the system at present adopted of using quinine in prophylactic doses on estates is sound.

E. P. Minett,
Acting Government Bacteriologist.

No. 3.

BRITISH GUIANA.

THE ACTING GOVERNOR to THE SECRETARY OF STATE.

(Received January 10, 1912.)

Government House, Georgetown, Demerara,
14th December, 1911.

SIR,

IN continuation of Sir Frederic Hodgson's despatch of the 29th June,* I have the honour to transmit a report on tropical diseases research work in the British Guiana Laboratory during the half-year ended 30th September, 1911.

I have, &c.,
CHARLES T. COX.

Enclosure in No. 3.

REPORT OF TROPICAL DISEASES RESEARCH IN THE GOVERNMENT BACTERIOLOGICAL LABORATORY, BRITISH GUIANA, FOR THE SIX MONTHS APRIL TO SEPTEMBER, 1911, BY K. S. WISE, Government Bacteriologist, and E. P. MINETT, Assistant Government Bacteriologist.

(1.) Description of a fungus on a hair.
(2.) Experiments on flies as carriers of leprosy.
(3.) The treatment of leprosy with Nastin and benzoyl chloride.
(4.) The examination of Georgetown for mosquito-breeding places.

(1.)

DESCRIPTION OF A FUNGUS ON A HAIR.

History.—This tinea occurs only among the aboriginal Indians up on the Brazilian border.

It is confined to women, the men cut their hair short and are not affected.

The hairs break off short at the nodules and are extremely brittle. The natives attribute it to bathing in the "white waters," and state that if they bathe in the "brown" peaty bush waters it does not occur.

It can easily be detected at sight with the naked eye as pearly grey bead-like thickenings on the hair.

The growth does not appear to occur near the roots. The native women cure it by cutting the hair short, but it seems to recur when the hair gets long again.

A similar condition has not been noted amongst the white, black, or coolie women in the Colony.

Examination.

Direct.—Glycerine.—Heaped up masses of spores apparently all on surface of hair. Do not see any filaments in substance of hair.

Caustic Potash.—Much the same only oblong spores in heaps plainer. Stained weak carbol fuchsin shows up a little better.

Broth.—Gives a cloudy growth. In hanging drop preparations under one-sixth looks like branches of oblong spores with very few branching filaments. One-twelfth oil immersion lens shows this culture to consist of ovoid shape spore-like bodies, each with a long tail, resembling a drum stick; many of the filaments have spores at each end.

P.S.—The fungus grows well in either glycerine or plain broth.

A very nice preparation can easily be obtained by washing a hair quickly in ether or chloroform, drying at once and then placing the hair on a recently prepared plate of glucose agar (or plain agar).

This method does away with the *Staphylococcus albus* on the hair, and if done quickly does not destroy the spores; these will then grow on the agar plate.

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* No. 2.

To get very good preparations for examination proceed as under; the method is rough, but does very well for a hot country, where fresh preparations are always best:—

Pour a very thin layer of agar or glucose agar in a thin glass shallow petri dish, allow to cool, and dry in incubator for four hours. Snip off several pieces of hair containing the nodules, rinse in ether or chloroform very slightly, and place on the surface of media. Incubate for 12 to 24 hours. A white growth spreads out from each of the nodules. Examine under $\frac{1}{4}$ inch objective direct.

Place on an area of growth " in situ " on plate a few drops of a very weak solution of carbol fuchsin containing about 2 per cent. glycerine. Allow to remain for about an hour. Pour off the superfluous stain, and examine the growth direct with a $\frac{1}{4}$ and one-sixth inch objectives.

This method, although rough and ready, and, of course, useless for a permanent preparation, has been found very useful indeed.

(2.)

Experiments on Flies as Carriers of Leprosy.

Experiments have been made with the object of throwing some light on the question of the possibility of flies acting as carriers of leprosy.

Three series of experiments were carried out. The first consisted in keeping 20 flies (*Musca domestica*) without food for a period of three days in a sterile glass bottle. They were then removed to another sterile glass bottle and covered with mosquito netting. The bottle was then opened and inverted over a breaking-down leprous nodule, known to contain enormous numbers of leprosy bacilli. They were allowed to feed on the breaking-down surface for several minutes.

The bottle was then kept in the laboratory for 48 hours; at the expiration of this period the flies were killed with chloroform, and removed from the bottle into sterile test tubes containing sterile normal saline solution, thoroughly shaken up, and allowed to soak for two hours. The bodies of the flies were then removed, and the fluid in which they had been washed was centrifugalised, the deposit being spread on slides and stained by the Ziehl Neelsen method.

These slides when examined showed the presence of a large number of typical leprosy bacilli, showing that the flies obviously carried about the bacilli on their feet and other external parts which may come in contact with the infected material. Twenty per cent. of the flies so examined showed positive results. The washed flies were then dissected out, and the intestines placed on sterile glass slides. It was then easy to press out the contents with a needle, and, after drying, to stain and examine the intestinal contents for the presence of leprosy bacilli.

Of these flies, a fair proportion were shown to have leprosy bacilli present in their intestine. Two cases showed the presence of the bacilli in an unchanged condition as far as the morphology was concerned; of the remainder several slides showed the presence of the bacilli in various stages of degeneration. Finally the sterile bottle, in which the flies had been kept after feeding, was washed out, to remove the fæces, with sterile saline. These washings were then collected in test tubes, allowed to stand for 8 hours, and the lower portions of the fluid containing the sediment centrifugalised. The deposit so obtained was stained in the usual way; 25 per cent. of the slides examined showed the presence of leprosy bacilli in a practically unchanged form.

The above experiment was repeated twice at intervals of about a month, the length of time in which the flies were kept alive after feeding being varied from one up to ten days before examining the fæces in the bottle.

Twelve attempts made to infect guinea pigs with the intestinal contents, the fæces, and even scrapings from the leprosy nodule itself proved a failure. The methods employed were various :—

(1) By applying the material to the raw surface of an artificially produced blister.
(2) By injections of emulsions into the groin.
(3) By injections of emulsions into the peritoneum; and
(4) By scarifying the skin and rubbing in the infected material.

All of the above were failures, but it is probable that had a more susceptible animal such as rats been available the result would have been different. Guinea pigs are apparently not susceptible to leprosy.

Conclusion.

1. The ordinary non-biting Muscidæ such as *Musca domestica* can convey about leprosy bacilli on their feet and body.
2. The leprosy bacilli remain unchanged in the intestines of these muscidæ after several days.
3. The leprosy bacilli can be detected in practically unchanged condition in flies' fæces after 10 days.

Reports Enclosed.

A. Further report on Nastin treatment.
B. Report on cases treated with benzoyl chloride.
C. Report on some untreated cases.

(3.)—A.

FURTHER REPORT ON THE NASTIN TREATMENT OF LEPROSY CARRIED OUT AT THE LEPER ASYLUM, MAHAICA, BRITISH GUIANA, FROM SEPTEMBER, 1910, TO SEPTEMBER, 1911.

Since September, 1910, this treatment has been carried out on the same lines as before, a few minor modifications only being introduced.

Of the 24 cases selected 18 were under treatment with Nastin for practically two years; the remaining 6 cases were under treatment for periods ranging from six to nine months.

In September, 1910, all these cases were transferred from treatment with Nastin only to treatment with a solution of benzoyl chloride.

Results of the 24 cases treated first with Nastin and later with benzoyl chloride :—

Males	19
Females	5
	24

Race.

	Males.	Females.
Black	12	4
East Indian	2	0
Coloured	2	1
Portuguese	1	0
White	2	0
	19	5
Total	24	

Country of origin.

	Males.	Females.
British Guiana	14	5
Barbados	3	0
India	2	0
	19	5
Total	24	

Age incidence.

	Males.	Females.
10 to 20 years	7	3
20 „ 30 „	5	2
30 „ 40 „	7	0
	19	5
Total	24	

Approximate age of disease when treatment started.

	Males.	Females.
1 year and under	9	3
1 to 3 years	5	1
3 years and over	5	1
	19	5
Total	24	

Duration of treatment.

	Nastin.		Benzoyl chloride.	
	M.	F.	M.	F.
Under 1 year ...	6	0	9	3
1 year and over ...	13	5	10	2
	19	5	19	5

Presence or absence of bacilli with estimation of numbers present at end of period of observation.

	Males.	Females.
Many bacilli	10	3
Few bacilli	5	1
No bacilli	4	1
	19	5
Total	24	

Amount of destruction of bacilli observed.

	Males.	Females.
No destruction	3	0
75 per cent. destruction ...	7	0
50 ,, ,, ...	2	1
25 ,, ,, ...	3	3
No bacilli	4	1
	19	5
Total	24	

Type of cases.

	Males.	Females.
Nodular	9	2
Anæsthetic	4	3
Mixed	6	0
	19	5
Total	24	

Presence or absence of ulcers.

	Present.	Absent.
Males	13	6
Females	3	2
	16	8
Total	24	

Cases in which eye lesions were present.

	Present.	Absent.
Males	1	18
Females	1	4
	2	22
Total		24

Classification of results after treatment.

	Males.	Females.
Improved	4	1
Doubtful	8	2
Worse	7	2
Died	0	0
	19	5
Total		24

Careful clinical notes were taken of the condition of the patients under treatment at regular intervals.

A microscopical examination was also made frequently, and the findings noted under the date when the specimens were taken.

The numbers of bacilli present were estimated by the general characters of each slide in conjunction with the numbers of bacilli observed in several fields. As the whole of the estimations were made by the same observer they may therefore be taken to be approximately correct.

The amount of so-called destruction of bacilli was estimated by observing the number of bacilli showing plasmolysis in a constant total, the estimation being the work of the same observer in all cases in order to ensure uniformity of results.

The results of this treatment will be discussed later in the report.

B.

Report on 71 cases treated with benzoyl chloride.

No attempt was made to select these cases, the patients being taken under treatment as they presented themselves.

The treatment consisted in intramuscular injections of a 5 per cent. solution of benzoyl chloride in sterilised heavy petroleum oil (white oleum petrolatum). This was used in preference to an animal or vegetable oil owing to its freedom from water, as many of the former contain a considerable amount of water and cause a rapid decomposition of the benzoyl chloride.

This decomposition does not take place in a mineral oil, which also has the additional advantage in that it does not become rancid if exposed to air.

In addition to the injections a $2\frac{1}{2}$ per cent. solution of benzoyl chloride in oleum petrolatum was used weekly as a nasal spray, and ulcers and broken-down nodules were painted with this preparation.

The following are the results of these 71 cases in tabulated form :—

The total number of cases treated, 71.

Sex distribution.

Males	46
Females	25
Total	71

Country of origin.

	Males.	Females.
British Guiana	22	18
India	20	4
Barbados	3	2

	Males.	Females.
Africa	1	0
Madeira	0	1
	46	25
Total	71	

Race incidence.

	Males.	Females.
Black	19	15
East Indian	23	5
Mixed	2	1
White	0	1
Portuguese	2	3
	46	25
Total	71	

Age incidence.

	Males.	Females.
10 to 20 years	8	5
20 ,, 30 ,,	12	7
30 ,, 40 ,,	13	5
40 ,, 60 ,,	13	8
	46	25
Total	71	

Approximate duration of the disease when first treated.

	Males.	Females.
Under 6 months	13	10
6 months to 1 year	12	6
1 year to 3 years	9	3
3 years to 5 years	4	1
Over 5 years	8	5
	46	25
Total	71	

Length of treatment.

	Males.	Females.
Under 6 months	1	2
1 year and over	45	23
	46	25
Total	71	

Presence or absence of bacilli (at end of experiment).

	Males.	Females.
Many bacilli	20	6
Few ,,	5	6
No ,,	16	10
Irregular cases	5	3
	46	25
Total	71	

Destruction of bacilli observed.

	Males.	Females.
No destruction	2	1
75 per cent. destruction ...	10	1
50 ,, ,, ...	5	3
25 ,, ,, ...	5	4
No bacilli present	24	16
	46	25
Total	71	

Type of cases.

	Males.	Females.
Nodular	16	9
Anæsthetic	25	14
Mixed	5	2
	46	25
Total	71	

Presence or absence of ulcers.

	Males.	Females.
Present	26	16
Absent	20	9
	46	25
Total	71	

Presence of eye lesions.

Males	2
Females	3
	5 cases.

Classification of results.

	Males.	Females.
Improved	18	7
Worse	9	4
Doubtful	19	11
Died	0	3
	46	25
Total	71	

Comparison between 24 cases treated with Nastin, 71 cases treated with benzoyl chloride, and 8 cases that had received no treatment of any description, beyond removal to better conditions as regards food, cleanliness, &c., as obtained in the asylum in comparison with their former condition of poverty

Expressed as percentages of each total.

	Nastin. Per cent.	Benzoyl chloride. Per cent.
Improved	21	36
Doubtful	42	42
Worse	37	19
Died	0	3
Bacilli still present	79	52
Ulcers present	41	59
Eye lesions	8	7

Eight untreated cases were examined regularly as confirmatory evidence that anæsthetic leprosy tends to self cure; the following shows briefly their classification.

Patients cited as non-infective that have never been treated in any way.

Total number ... ... 8, all males.

Country of origin.

British Guiana	7
India	1
Total	8

Duration of disease.

5 years	1
5 to 10 years	3
10 ,, 20 ,,	4
Total	8

Race incidence.

Black	7
East Indian	1
Total	8

Age incidence.

20 to 30 years	2
30 ,, 40 ,,	2
40 ,, 50 ,,	2
50 ,, 60 ,,	2
Total	8

Type of disease.

Anæsthetic	6
Mixed	2
Nodular	0
Total	8

All show continued absence of bacilli.

Two show no ulcers, six have small ulcers.

Six show signs of decided improvement. Although contractions and amputations are present they appear no longer infective.

With regard to the plasmolysis or so-called destruction of bacilli, it has been before stated that this is a natural process and can be observed in untreated lepers. There appears to be no doubt that this view is a correct one, as after making careful notes of many cases in various stages of the disease, all of them untreated, it can be shown that the degree of destruction is totally unreliable as an index of the progress of treatment. Apparently the damaged appearance of the bacilli is merely the effect in them of a local tissue reaction, probably a partial phagocytosis or a bacteriolysis; it varies from time to time and also in different situations in the same patients.

C.

The following are the results of 12 cases examined periodically before any treatment was started. They were recorded for the purpose of having control cases

to compare with the amount of destruction observed in the cases treated with Nastin and benzoyl chloride. The amount of destruction was estimated in an exactly similar manner in all cases.

Untreated Cases.

Analysis of 12 cases examined before treatment of any kind was commenced :—

Presence or absence of bacilli.

Many bacilli	8
Few bacilli	4
Total	12

Amount of destruction of bacilli observed.

75 per cent. destruction	5
50 " "	2
25 " "	3
Destruction not estimated	2
Total	12

As regards the clinical observations the general effect was that the patients seemed brighter and the Medical Superintendent stated that they worked with a better will. This effect was equally well marked whether the cases were treated with Nastin or benzoyl chloride.

The opinion was formed that the improvement is almost entirely due to their improved mental condition; but whether entirely so or not it is diffcult to say.

Marked physical improvement nearly always follows removal from a condition of poverty and filth to a well ordered asylum, irrespective of any treatment, and an improvement can be readily understood in the mental attitude of an impressionable race such as form the bulk of our cases, when hope and interest are excited by a new treatment.

For example, by comparison made between many cases which have shown signs of improvement since admission to the asylum it appears that the improvement made is the same in untreated cases as in those under treatment.

There is no doubt that leprosy is a disease of exceptional obstinacy and also that its clinical and bacteriological conditions vary greatly from time to time quite independent of any treatment.

The length of time during which these cases have been treated of itself introduces such an element of doubt that it is unfair to ascribe the small amount of improvement made to the treatment but rather to the general tendency of the disease towards a natural recovery. Besides, were the Nastin treatment possessed of any marked influence on the course of the disease, the larger number of cases which get progressively worse as compared with those showing improvement more than negatives any claim to a beneficial effect, especially when the decided improvement in the eight untreated cases is considered.

Careful clinical and bacteriological examinations made during and after practically two years' treatment, show in a few cases only certain changes towards improvement; but these changes are too slight to give any hope of recovery.

With regard to benzoyl chloride its use as a nasal spray is of great value; cases in which large numbers of leprosy bacilli were shown to be present in the nasal mucous membrane rapidly lost all traces of bacilli under the use of a 2½ per cent. solution.

On broken-down nodules and ulcerating surfaces in which enormous numbers of bacilli were present it caused a rapid disintegration and destruction of bacilli.

Its subcutaneous injection seems to be of very doubtful utility.

The relative number of cases showing apparent improvement under benzoyl chloride is greater than in those treated with Nastin; it must, however, be borne in mind that the patients treated with Nastin contained a larger percentage of nodular cases than those treated with benzoyl chloride, the numbers being 45 per cent. for Nastin and 35 per cent. for benzoyl chloride, a difference of 10 per cent.

Therefore, as the cases treated with benzoyl chloride show a 15 per cent. larger number of cases with apparent improvement over those treated with Nastin, it would appear that the ratio of improvement should read as nearly equal, with a small margin of 5 per cent. in favour of the benzoyl chloride.

We beg to tender our thanks to the Medical Superintendent at the Leper Asylum for assistance in carrying out these investigations.

Conclusions.

1. That Nastin has apparently very little beneficial effect on cases of leprosy.
2. A solution of benzoyl chloride in oil shows a slightly higher percentage of improvement than Nastin.
3. Anæsthetic cases of leprosy run a definite course, after which the disease seems to die out, leaving the patient no longer infective.
4. These cases recover sensation after a time in areas previously anæsthetic; and after self amputation only scars remain. This is a natural process and takes place without any treatment whatever; it is not, apparently, influenced by either Nastin or benzoyl chloride.
5. Nodular cases do not tend to improve naturally as above, except in very rare instances; nor do they appear to be affected appreciably by either Nastin or benzoyl chloride.
6. The so-called destruction of bacilli is a natural process varying considerably and does not appear to be influenced by Nastin or benzoyl chloride.
7. Variation in the amount of destruction of bacilli observed is of limited value as an indication of the effects of treatment.
8. Benzoyl chloride in petroleum oil is extremely valuable as a nasal spray or a paint for ulcerating surfaces. It quickly renders the discharge free from the presence of bacilli.
9. Its regular use for this purpose is strongly recommended in leper asylums.

(4.)

An Examination of the City of Georgetown for the Breeding Places of Mosquitos.

As long ago as June, 1909, it was proposed to make a close examination of Georgetown with reference to the presence and distribution of mosquitos in the City. Difficulties arose as to the right of entry on premises, and it became necessary to await the passing of a mosquito ordinance bestowing powers of entry; this was achieved in September, 1910.

In December, 1910, the systematic examination of Georgetown was commenced and especial notice was directed to the kind of mosquito, larvæ, or egg found, nature of the places in which breeding was actually occurring, to potential breeding places (*i.e.*, where breeding might occur at times other than that of the visit of inspection) and to the conditions of vats and other water receptacles.

Between December, 1910, and August, 1911, half of the City had been examined by the Assistant Government Bacteriologist (Dr. Minett) and Dr Duncan with two trained laboratory assistants. Dr. Browne, the Acting Medical Officer of Health, had examined some of the City water trenches.

The return of the Government Bacteriologist and the concentration of the forces of the Bacteriological Department made it possible to complete the examination on the work by the end of September, 1911.

This survey compassed the whole of the City and included also certain premises and waste land lying to the windward side; all premises, without exception, were inspected and reported on, lot by lot.

Two thousand five hundred and sixty premises were examined and of these 1,490 were found to be breeding mosquitos at the time of inspection.

The following table shows concisely the various districts of the City, the time of the year when examined, the number of premises, the number, with percentage, of these breeding mosquitos, the number of premises breeding *Stegomyia fasciata*, *Culex fatigans*, *Anopheles* (*Cellia albipes*) and other mosquitos.

District.	Date of Examination.	Premises.	Premises Breeding Mosquitos.	Percentage.	*Stegomyia Fasciata.*	*Culex fatigans.*	Anopheles.	Other Mosquitos.
Kingston ...	Dec. to Feb., 1911.	131	71	54·2	58	27	—	—
Stabroek ...	Feb., 1911	126	64	50·7	58	9	—	7 *Culicelsa taeniorhynchus.*
Queenstown ...	Feb., 1911	101 Much unoccupied land.	78	77·2	70	15	2 Premises. Frequent in unoccupied land.	9 *Culicelsa taeniorhynchus.*
Charlestown ...	March to May, 1911.	254	198	77·9	181	20	1	1 *Culex confirmatus.* 2 *C. taeniorhynchus.*
Alberttown ...	May to July, 1911.	269	221	82·1	202	38	8	2 *Aediomyia squammipenna.*
Cummingsburg	Aug. to Sept., 1911.	245	152	62·0	138	35	2	1 *Culicelsa taeniorhynchus.*
Bourda	Sept., 1911	399	131	32·9	125	15	—	—
Lacytown ...	Sept., 1911	319	133	41·6	125	12	—	—
Robbstown and Newtown.	Sept., 1911	48	12	25·0	11	—	1	—
Werken Rust ...	Sept., 1911	333	201	60·3	175	37	3	—
Wharves, Riverside.	Sept., 1911	53	18	33·8	18	1	—	—
Wortmanville ...	Sept., 1911	182	145	79·6	138	34	2	*Melanoconion atratus.*
Railway line ...	Sept., 1911	100	66	66·0	63	7	2	2 *Aediomyia squammipenna.*
Total ...	—	2,560	1,490	58·3	1,362	250	21	25

The following table indicates the number of vats screened, defectively screened, and totally unscreened, also the number of premises with potential breeding-places and also the number of these in which the yards and grounds are in a disgraceful condition.

Ward.	Vats screened well.	Vats screened defectively.	Vats unscreened.	Potential breeding-places.	Disgraceful yards.
Kingston	83	51	6	73	13
Stabroek	103	102	8	70	6
Queenstown	64	70	8	90	36
Charlestown	184	155	12	204	26
Alberttown	197	122	—	241	8
Cummingsburg	646	284	13	214	18
Bourda	333	138	13	216	24
Lacytown	283	213	12	185	22
Robbstown and Newtown ...	43	15	2	14	8
Werken Rust	421	170	6	275	68
Wharves, Riverside	99	20	6	28	4
Wortmanville	145	51	1	162	34
Railway line	4	5	1	76	4
Total	2,605	1,396	88	1,848	261

The great majority of the breeding-places and potential breeding-places are barrels. Of these 1,848 premises on which breeding or potential breeding-places are found no less than 1,203 were due to barrels. Of these barrels only 11·5 per cent were screened.

The trenches (used for draining the level land) to the windward side of the town contained numerous *Culicelsa taeniorhynchus*, *Aediomyia squammipenna*, *Melanoconion atratus*, and where grass and vegetation were present on the surface also numerous *Cellia albipes*.

In the large trenches in the City the same mosquitos were found and the same observations apply.

No. 4.

CEYLON.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received 27 February, 1911.)

The Queen's Cottage, Nuwara Eliya, Ceylon,
7th February, 1911.

SIR,

I HAVE the honour to forward herewith, for transmission to the Advisory Committee of the Tropical Diseases Research Fund, a report by Dr. Aldo Castellani, M.D., on research work done in the Clinic for Tropical Diseases and Bacteriological Institute during the half-year ending 31st December, 1910.

I have, &c.,
HENRY McCALLUM,
Governor.

Enclosure in No. 4.

REPORT on the research work carried out at the Clinic for Tropical Diseases and Bacteriological Institute from 1st July to 31st December, 1910, by ALDO CASTELLANI, M.D., Director, Clinique for Tropical Diseases and Bacteriological Institute.

As previously, the routine work has taken most of my time. The number of specimens received during 1910 for various bacteriological examinations from hos-

pitals, private practitioners, &c., has been 1,530; on adding the specimens from the Clinic and Seamen's Ward, a total exceeding 2,000 is reached. Among these examinations there have been numerous examinations for cholera, several complete analyses of water, and 78 examinations of brains of dogs for rabies. During my spare time researches have been carried out on the following subjects, viz. :—

(1) The hypomycetes of tinea imbricata : their growth on artificial media and the experimental reproduction of the disease.

(2) A new species of epidermophyton found in tinea alba.

(3) A new species of trycophyton found in tropical tinea capitis.

(4) Further experiments on fungi of the genus endomyces affecting man in the Tropics.

(5) The treatment of yaws (*Framboesia*).

I wish to express my indebtedness to Mr. E. Burgess for the continuous assistance he has rendered me during all the investigations.

I.—The Hypomycetes of Tinea Imbricata.

The fungus of tinea imbricata was discovered by Sir Patrick Manson in 1872. Since then there has been much discussion on the botanical position of the fungus and on the possibility of its growth on artificial media. According to many observers it is an aspergillus-like fungus; according to others, a tricophyton : *Tricophyton concentricum* (Blanchard). My experiments have led me to the conclusion that it is neither an aspergillus nor an ordinary tricophyton; I have established for it, as well as for the fungus of tinea intersecta, a new genus : *Endodermophyton.* It would seem that there is more than one species of fungus capable of inducing the disease. In Ceylon at least two species can be differentiated. For the first species, I have maintained the name of *Endodermophyton concentricum* (Blanchard); for the second, I propose the name of *Endodermophyton indicum.*

Endodermophyton concentricum : Microscopical and cultural characters.—Preparations in liq. potass from scales show a felt of interlacing mycelial tubes; the segments are rather regular in shape, somewhat square-shaped and usually straight. If the liq. potass be left to act some time the mycelial articles, which are of very variable length and $2\frac{1}{2}$ to $3\frac{1}{2}$ micron in breadth, will be seen to have a double contour. Aspergillar-like fructifications are always absent, in my experience. Fresh preparations from young cultures show abundant septate mycelium, with rather long straight articles; in old cultures, the shape of the mycelial tubes may be irregular. In hanging drop cultures (Sabouraud's broth), long mycelial septate threads are seen; no free spores. Reproduction is apparently by sprouts from the mycelium, branching taking place. The cultural characters on solid media when the growth is 15 to 21 days old are as follows :—

Glucose agar (4 per cent.).—Growth abundant, surface cerebriform or crinkled. The growth and the medium show a slight amber colour, which later on may become of much deeper hue. No duvet.

Sabouraud's agar.—Growth comparatively scanty, whitish-grey, mostly submerged. The colonies have generally a small central knob, and never show any duvet. The submerged portion is very firmly imbedded, and presents projections deepening in the medium. Colour of the medium unchanged.

Mannite agar (4 per cent.).—Appearance somewhat similar to glucose, but growth less abundant. The medium may take a slight amber colour; no duvet.

Saccharose agar (4 per cent.).—Growth rather scanty, similar to Sabouraud; duvet absent.

Glycerine agar (4 per cent.).—Similar to Sabouraud; when the colonies coalesce the growth shows a knobby surface. No duvet.

Nutrose agar (4 per cent.).—Slow growth; separate young colonies have a central knob. When they coalesce a knobby mass is formed.

Agar.—Scanty growth, somewhat similar to Sabouraud; no duvet.

Maltose agar (acid).—Similar to Sabouraud.

Maltose agar (alkaline).—Similar to Sabouraud.

Adonite agar.—Not very abundant, cerebriform; duvet absent.

Galactose agar.—Knobby or cerebriform.

Levulose agar.—Knobby.

Raffinose agar.—Cerebriform.

Inuline agar.—Cerebriform.

Saccharine agar (4 per cent.).—Somewhat knobby surface; duvet absent.

Lactose agar.—Similar to Sabouraud, but surface growth more abundant.

Gelatine.—Very slow liquefaction of the medium.

Milk.—Very scanty growth; after a time the medium becomes separated.

Sugar broths (maltose, lactose, &c.).—Slight growth at the bottom of the tube; no production of acid or gas.

Endodermophyton indicum, n. sp.: Microscopical and cultural characters.—The microscopical appearance of this fungus is to all purposes identical to that of *Endodermophyton concentricum.* The cultural characters on solid media, when the growth is between 15 and 21 days old, are as follows :—

Glucose agar (4 per cent.).—Growth fairly abundant, with surface somewhat convoluted or furrowed; portion of the growth, often the central, is of a deep orange, or pinkish-orange, or red orange colour. The surface of the rest of the growth appears white and powdery, being covered by a very short and delicate duvet.

Sabouraud agar.—Slow growth, white powdered surface, either with central knob or furrowed. The growth does not deepen in the medium so much as *Endodermophyton concentricum.*

Mannite agar.—Growth knobby or convoluted; covered by white short duvet.

Saccharose agar.—Cerebriform, covered by white duvet.

Saccharine.—Crinkled surface, delicate white duvet present.

Maltose agar (acid).—Somewhat similar to Sabouraud, but the surface growth is more abundant.

Maltose agar (alkaline).—Similar to acid maltose, but the white duvet is more abundant.

Lactose agar.—Knobby surface, covered by snow-white duvet.

Glycerine agar.—Growth abundant, yellowish or amber colour, delicate white short duvet present on some portions of the growth.

Nutrose agar.—Yellowish surface, crinkled; short white duvet present.

Agar.—Growth fairly abundant, knobby surface covered by snow-white, very short, delicate duvet.

Levulose agar.—Scanty growth, yellow or orange, scarce; very short white duvet present.

Galactose agar.—Fairly abundant, surface convoluted with abundant short snow-white duvet.

Raffinose agar.—Same appearance as galactose.

Inuline agar.—Same appearance as in galactose and raffinose agars.

Adonite agar.—Cerebriform surface covered with snow-white duvet.

Gelatine.—Very slow liquefaction.

Lit. milk.—Very scanty growth (after a time the medium may become separated).

Various sugar broths (Maltose, lactose, &c.).—Slight growth at the bottom of the tube. No production of acid or gas.

Comparison between the cultural characters of Endodermophyton concentricum and of Endodermophyton indicum.

The annexed table shows at a glance the different cultural characteristics of the two fungi in the principal media :—

Table showing the principal cultural characters of Endodermophyton concentricum *and* Endodermophyton indicum.

Media.	Endodermophyton concentricum.	Endodermophyton indicum.
Glucose agar ...	Amber colour. Duvet absent ...	Deep orange with occasionally pinkish hue. White, very short delicate duvet.
Sabouraud agar ...	Growth scanty; mostly submerged and grey-whitish. Duvet absent.	Surface growth more abundant. Powdery; white.
Agar	Scanty; mostly submerged. Similar to Sabouraud agar. No duvet.	Fairly abundant; knobby. Well marked snow-white duvet.
Glycerine agar ...	Growth mostly submerged. Surface growth very scanty; similar to Sabouraud agar. No duvet.	Surface growth very abundant; crinkled appearance. Slight white short duvet present.

Experimental Tinea Imbricata by Inoculation of Cultures of Endodermophyton Concentricum *and* Endodermophyton Indicum.

A Sinhalese boy—Abraham—whose skin was perfectly normal, developed after about two weeks three small patches of tinea imbricata at the three spots of inoculation. These patches have gradually enlarged, and are now (January, 1911) extremely itching, so that, the patient being unwilling to continue the experiment, I have decided to treat them.* From the scales of the patches the *Endodermophyton concentricum* has been grown with the identical characters of the strain used for the inoculation of the boy.

More recently (November, 1910) I have inoculated a native who voluntarily submitted himself to the experiment with a pure culture of *Endodermophyton indicum.* This native, a Sinhalese lad named Hinniappu, 17 years of age, had his skin free from eruptions of any kind. I scarified his skin with a sterile knife, drawing a little blood, on five different spots : one on the right arm, one on the left arm, and three on the back. A certain amount of pure agar culture of *Endodermophyton indicum* was then well rubbed in.

After three weeks small roundish patches of tinea imbricata developed at four out of the five places at which he had been inoculated. The patches have gradually increased in size, and are at the present time very pruriginous. The scales of all the patches examined microscopically in liq. potassae show a large amount of mycelium, and on cultivation a fungus has been grown absolutely identical to the strain of *Endodermophyton indicum* with which the boy was inoculated.

Conclusions:—

(1) The hypomycetes of tinea imbricata can be grown on artificial media.

(2) It would seem from my researches that there is a plurality of species of fungi producing the disease.

(3) In Ceylon at least two different species can be differentiated : *Endodermophyton concentricum* (Blanchard) and *Endodermophyton indicum n. sp.*

(4) The disease can be experimentally reproduced in human beings by inoculating cultures either of *Endodermophyton concentricum* or of *Endodermophyton indicum.*

(5) It is possible that the further investigation of tinea imbricata may show that to different species of fungi correspond slightly different clinical varieties of tinea imbricata. I have had the impression that the lesions produced by *Endodermophyton indicum* are somewhat less severe and slightly more superficial than those induced by *Endodermophyton concentricum*, but of course much further investigation is required to clear this point.

* The treatment of isolated patches is comparatively easy, but the difficulty of treating Tinea imbricata when diffuse is well known : what in my hands has answered best is the method of treatment I introduced several years ago, viz., Resorcin dissolved in Tr. Benzoïn according to the formula :—Resorcin, 2 drachms ; Tr. Benzoin, 1 ounce.

II.—A New Species of Epidermophyton found in Tinea Alba

From a case of long-standing tinea alba, in a native, a new epidermophyton was grown, for which I suggest the name of *Epidermophyton Asiaticum.*

The patient—Karuppa, a Tamil cooly—presented on the back diffuse whitish patches of various shape—no rings, scales white and rather thick. The principal characters of this fungus in cultures three weeks old are as follows :—

Sabouraud agar.—Scanty growth, with central knob and whitish powdery surface. A small portion of the central growth may present a slight reddish tinge.

Glucose agar.—Very abundant growth; powdery, snow-white surface; after a time abundant white duvet present.

Maltose (4 per cent).—Very scanty, somewhat similar to Sabouraud.

Glycerine agar.—Abundant growth; white duvet present; a slight reddish tinge may be detected in portions of the growth.

Nutrose agar.—Abundant white growth; duvet present.

Agar.—Scanty growth, similar to maltose.

Adonite agar.—Abundant growth, white powdery surface; a reddish tinge of the growth may sometimes be observed.

Saccharine agar.—Fairly abundant growth; colonies have a central knob, powdery white surface.

III.—A New Species of Tricophyton found in a form of Tropical Tinea Capitis.

In Ceylon a peculiar type of tinea capitis is found, especially among native children, differing clinically from the ordinary forms of tinea capitis observed in Europe. The child presents several whitish patches on the scalp the size of less than a sixpenny-piece; the patches appear white, being covered with abundant whitish scales; there are stumps of hairs, but no black dots are visible. The patches have the greatest resemblance to patches of impetigo of the scalp in the late stage when they are drying up. Occasionally the patches resemble more closely psoriasis than any other affection. If the scales and hair be examined in liq. potass, a fungus with all the microscopical characters of a large-spored tricophyton endo-ectothrix will be found. The fungus is easily grown. The cultural characters when the growth is between two and three weeks old are as follows :—

Glucose agar.—Growth abundant, of a deep-red, port wine-like colour; after several transplantations the pigmentation is less marked, and may disappear completely.

Sabouraud.—Scanty growth with central knob, whitish.

Maltose (acid), *Maltose* (alkaline).—Similar to Sabouraud.

Glycerine.—Fairly abundant growth, deep red.

Mannite.—Similar to Sabouraud.

Nutrose.—Similar to glycerine.

Levulose.—Similar to glycerine.

Galactose.—Whitish central growth surrounded by a reddish ring.

Raffinose.—Similar to Sabouraud.

Inuline.—Similar to Sabouraud.

Adonite.—Similar to glycerine.

Further experiments on fungi of the Genus Endomyces affecting man in the Tropics.

In previous reports I have called attention to the frequency in Ceylon of a form of bronchomycosis caused by endomyces. During the last six months numerous other cases have been investigated, and besides the *Endomyces tropicalis* described by me previously, several other species have been found.

The sugar reactions of these eight species, as well as those of *Endomyces tropicalis*, are collected in the following table :—

—	Litmus milk.	Glucose.	Lævulose.	Maltose.	Galactose.	Saccharose.	Lactose.	Mannite.	Dulcite.	Dextrin.	Raffinose.	Arabinose.	Adonite.	Inulin.	Broth.	Peptone water.	Indole.	Gram.	Gelatine.	Serum.
Endomyces tropicalis	O.[4]	A.G.	A.G.	A.G.	A.G.[6]	A.G.	O.	O.	O.	O.	O.	O.	O.	O.	1	3	O.	+	O.[7]	O.
" A.	A.C.	A.G.	A.G.	O.	A.G.[6]	A.G.	A.G.	O.	O.	O.	O. ?	O.	O.	O.	3	3	O.	+	O.[7]	O.
" B.	[8] ALK. PEP.	A.G.	A.G.	A.G.	A.G.[6]	O.	O.	O.	O.	O.	O.	O.	O.	O.	2	3	O.	+	O.[7]	O.
" C.	[9] D.C.	A.G.	A.G.	A.	A.	A.	A.	A.	O.	A.	A.	O.	O.	O.	1	2	O.	+	O.[7]	O.
" D.	O.[4]	A.G.	A.G.	A.G.	A.G.	A.G.	O.	O.	O.	A.[6]	O.	O.	O.	O.	1	2	O.	+	O.[7]	O.
" E.	O.	A.G.	A.G.	O.	O.	O	O.	O.	O.	O.	O.	O.	O.	O.	2	3	O.	+	O.[7]	O.
" F.	O.[5]	A G.	A.	A.	A.	A.G.	O.	O.	O.	O.	A.G.[6]	O.	O.	O.	2	2	O.	+	O.[7]	O.
" G.	O.[5]	A.G.	A.G.	A.	A.G.[6]	A.G.	O.	O.	O.	O.	A.G.[6]	O.	O.	A.[6]	2	2	O.	+	O.[7]	O.
Saccharomyces Krusei	O.	A.G.	A.G.	O.	O.	O.	O.	O.	O.	O.	O.	O.	O.	O.	3	3	O.	+	O.[7]	O.

Abbreviations used in the table :—A.=Production of acid. G.=Production of gas.
O.=Negative result, viz. :—neither acid nor clot in milk, neither acid nor gas in sugar media or non-liquefaction of gelatine or serum, as the case may be.
1=Clear, thin pellicle. 2=Clear, good bottom growth, no pellicle. 3=Practically no growth. 4=If any change, slightly alkaline. 5=Alkaline in seven days.
6=Trace only. 7=Non-liquefied three weeks. 8=Alkaline, then peptonisation. 9=Decolourised. Clot in five days.

The reactions given in the above table clearly show that there is in Ceylon a plurality of species of endomyces affecting man, eight species having been so far isolated.

Treatment of Yaws.

The methods of treatment so far used in yaws are not very satisfactory. According to my researches, mercury has practically no action on the disease, while potass. iodid., though fairly successful in many cases, is not so in all. Atoxyl has been found useful, especially if given together with potass. iodid., but the highly toxic power of the drug renders its use dangerous.

Having received from Professor Ehrlich in June last a certain amount of his " 606," I tried it in some cases of yaws. Eight patients were treated: six recent cases presenting the granulomatous eruption, and two old cases showing the late lesions of the disease which are so often confused with the tertiary lesions of syphilis. Each patient had one injection only (grms. 0·30 or 0·50) of the powder rubbed with a little methyl alcohol and dissolved in sterile water. The injection was done hypodermically by means of a strong sterile all-glass syringe in the upper external region of the thigh, in all except the first patient, who had the injection intramuscular in the gluteal region. The injection in the external region of the thigh seems to be less painful than the intramuscular injection in the gluteal region; moreover, when the severe inflammation following the injection sets in, hot fomentations, bandaging, &c., to relieve the pain, are more easily carried out on the thigh. The patients presenting the general granulomatous eruption recovered as regards the skin lesions within two weeks; one has had a relapse recently (October), which has easily yielded to a second injection; the other five do not show any trace of the disease except the hyper-pigmented spots which remain at the place of the granulomata when these heal up. These patients therefore are apparently cured. I use the word *apparently* because yaws is a very insidious disease and the infection may remain dormant (perhaps in the lymphatic glands or internal organs) for many months and years. As regards the two old cases of at least ten or fifteen years' duration presenting the late lesions of the disease, they were distinctly benefited by the injection, but the lesions were not cured; possibly a stronger dose of the medicament or repeated injections would have been more successful.

In the six recent cases there is no doubt that the eruption disappeared more rapidly than with any other method of treatment I know of—including potass. iodide and atoxyl. It would seem, therefore, from my experiments, that Ehrlich's " 606 " will be found to be of the greatest benefit in yaws.

ALDO CASTELLANI.

No. 5.

CEYLON.

THE ACTING GOVERNOR to THE SECRETARY OF STATE.

(Received 21 August, 1911.)

SIR, The Queen's House, Colombo, Ceylon, 31st July, 1911.

WITH reference to Sir Henry McCallum's despatch of the 7th February, 1911,* I have the honour to forward herewith, for transmission to the Advisory Committee of the Tropical Diseases Research Fund, a report by Dr. Aldo Castellani, M.D., on research work done in the Clinic for Tropical Diseases and Bacteriological Institute during the half-year ended 30th June, 1911.

I have, &c.,
HUGH CLIFFORD,
Officer Administering the Government.

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* No. 4.

Enclosure in No. 5.

REPORT on Investigation Work carried out in the Government Clinic for Tropical Diseases and Bacteriological Institute during the period from January 1st to June 30th, 1911, by Aldo Castellani, M.D.

As previously, the routine work has been very heavy at both institutions; during my spare time I have carried out some investigation work on the following subjects :—

(1) Cases of fever probably due to bacillus Asiaticus I. and bacillus Asiaticus II., with observations on some other intestinal bacteria.
(2) A peculiar trychomycosis.
(3) A new species of trychophyton affecting man.

I would like to express here my thanks to Mr. Burgess for the continuous assistance he has rendered during these researches.

Cases of fever probably due to bacillus Asiaticus I and II

In 1905, in a case of anchylostomyasis presenting a long protracted fever, which did not cease after the patient got free of the parasite, I isolated from the stools and from the blood a peculiar bacillus which I named Bacillus Asiaticus. The same bacillus I found later in a case of protracted fever in which anchylostoma and any other worms were absent. More recently I have observed in two other cases of fever a closely-allied organism to be presently described, and which, for convenience sake, I will indicate with the term bacillus Asiaticus II.

Case 1.—A Singhalese boy, age 11, admitted to the Clinic in June, 1905, with well-marked signs of anchylostomyasis. General œdema, extreme pallor of the palpebral conjunctiva, &c. There was fever of low, intermittent type—the daily maximum reaching about 100°—said to have been present for four months. The stools contained numerous ova of *Anchylostoma duodenalis*. *Eucalyptus-chloroform* treatment repeated three times cured the anchylostomyasis, but the fever continued of the same low, intermittent type. From the stools bacillus Asiaticus I. was isolated, and the same germ, by means of the " dilution method," was also grown from the blood. Two months after the last anthelmintic treatment, considering that the fever was probably due to the germ isolated from the patient's blood, I prepared with that germ a vaccine and I injected the patient with it twice. The first time I only inoculated ½ c.c. of a 24 hours' old broth culture heated for an hour to 55°-60° : the temperature rose a little, but the course of the fever was not influenced. The second time—a week later —I injected 1½ c.c. of the vaccine prepared in the same manner; three hours after inoculation the temperature rose to 105°, the patient becoming very sick. The day after the fever stopped completely, and did not recur. Whether the dropping of the fever was really due to the vaccine injection cannot be said with certainty, but there is a strong probability of this being so. The blood of this boy strongly agglutinated bacillus Asiaticus six months after the fever stopped; after a year no agglutination was present.

Case 2. Thobias.—A Singhalese, 28 years of age, kitchen cooly of the Clinic, had low, quotidian fever, at times subcontinuous, at times intermittent, for 9 weeks. Repeated examinations for malaria, Malta fever, typhoid, paratyphoid, negative. Tubercular reactions (ophthalmic and cuti reaction) negative. The blood agglutinated 1 in 80 bacillus Asiaticus. The examination of the stools remained negative twice, but the third time two colonies of bacillus Asiaticus were isolated. Attempts at growing the germ from the blood, repeated four times, always failed. The agglutinins for bacillus Asiaticus disappeared four months after the fever ceased.

Cases of fever in which bacillus Asiaticus II. was found.

Case 1.—Fernando, Singhalese, a medical student, admitted to the Seamen's ward, General Hospital, with fever, said to have begun a month previously. Nothing worth noting in his past medical history. Part of the course of the fever is shown in the temperature chart No. 1. The temperature never rose very high; no shivering fits, no sweatings. The general condition of the patient was never very serious; his mind always clear. He complained, especially during the latter course of the disease, of severe abdominal pains along the descending colon and sigmoid. There was constipation alternating with slight diarrhœa : no blood or mucus present in the stools :

numerous eggs of *Ascaris lumbricoides* present. After a santonin treatment he passed several ascarida, and the eggs disappeared from the stools, but the pains persisted. The patient left the hospital still having the fever; it lasted another month; four months in all.

Microscopical and bacteriological examinations carried out in above cases.

Case 1.—Widal reaction repeated ten times negative. Serum reaction for paratyphoid A and B and Malta fever negative. Examinations of the blood for the bacillus typhosus using the bile media and the dilution method negative. In the stools examined six times the bacillus typhosus and paratyphosus A and B were absent; colonies of bacillus Asiaticus No. II. were present twice. The blood agglutinated bacillus Asiaticus II. in a dilution of 1 in 100; did not agglutinate bacillus Asiaticus I., nor, as I have already mentioned, bacillus typhosus, bacillus paratyphosus A and B, *Micr. melitensis,* and none of the bacilli of the dysentery group. The agglutination of bacillus Asiaticus II. persisted in the same strength for two months after the fever was over; then the amount of agglutinus gradually decreased until 7 months after the termination of the fever no agglutination was present even in a dilution of 1 in 10.

Case 2.—Dr. G., European, 30 years. The illness began with slight serotine fever, and feeling of slight lassitude, about the middle of May, 1911. Entered the General Hospital of Colombo on the 25th May, 1911. General condition fairly good, no headache, mind perfectly clear. The fever lasted three weeks : never very high. The patient was never in a typhoid state : mind always clear, tongue not very coated, no roseolae, no enlargement of the spleen. He complained during the last two weeks of severe abdominal pains, with some tenderness on pressure along the left epicolon and the sigmoid regions, but never had diarrhœa or any blood or mucus in the stools. Eggs of worms absent.

Bacteriological examination of blood.—Serum reaction for bacillus typhosus, paratyphosus A and B repeated four times during the disease, and once after the fever had stopped, negative. Examination of the blood (repeated twice) for the presence of the typhoid bacillus by means of bile media, negative. Serum agglutination for Malta fever repeated twice, negative; for bacilli of the dysentery group (Kruse-Shiga and Flexner) negative. Sero agglutination for bacillus Asiaticus II. positive 1 in 200; for bacillus Asiaticus I., negative above 1 in 10.

Stools.—No protozoa, no eggs of worms. Bacteriological examination for bacillus typhosus, paratyphosus A and B, and dysentery bacilli constantly negative. Two colonies of bacillus Asiaticus II. were isolated on one occasion.

Description of bacillus Asiaticus I.—A short rod, 2-5micron. in length, closely resembling the bacilli of the dysentery group. Non motile. Brownian movement not very marked.

Culture characters. Broth.—Growth fairly abundant with general turbidity of the medium. During the first two days no pellicle is noticeable; later on a pellicle is often present.

Pepton water.—General turbidity, no pellicle.

Agar.—Colonies whitish, roundish, typhoid-like; after a time coalesce together into a whitish mass.

Gelatine —Typhoid like, no liquefaction.

Serum.—Nothing characteristic.

Blood serum.—Nothing characteristic.

Action on various sugars:—

Lactose litmus broth 2 per cent.—No acidity. No gas.
Saccharose litmus broth 2 per cent.—Acid and gas. Medium slightly decolourised.
Dulcite litmus broth 1 per cent.—No acidity. No gas.
Mannite litmus broth 2 per cent.—Acid and gas.
Glucose litmus broth 2 per cent.—Acid and gas.
Maltose litmus broth 2 per cent.—Acid and gas. Medium decolourised.
Dextrin litmus broth 1 per cent.—Acid and gas. Medium decolourised.
Raffinose litmus broth 1 per cent.—Acid and gas. Medium decolourised.

Arabinose litmus broth 1 per cent.—Acid and gas.
Adonite litmus broth 1 per cent.—No acidity. No gas.
Inulin litmus broth 1 per cent.—No acidity. No gas.
Sorbite litmus broth 1 per cent.—Acid and gas. Medium decolourised.
Galactose litmus broth 1 per cent.—Acid and gas.
Lævulose litmus broth 1 per cent.—Acid and gas.

Indol.—Slight.

Pathogenicity.—Intraperitonial injection of 1 c.c. broth culture of a recently isolated strain kills guinea pigs in 24 to 36 hours; subcutaneous injections of ordinary doses do not kill the animals and give rise to only slight symptoms.

Bacillus Asiaticus No. 2.—This strain is practically identical to bacillus Asiaticus No. 1 morphologically and culturally. Minor differences, but not constant, are found in litmus milk, and occasionally in dulcite. In milk—as is the case with bacillus Asiaticus No. 1—there is no production of acidity nor clotting; in litmus milk bacillus Asiaticus No. 2 decolourises the medium within 24 hours, the blue colour completely disappearing; the medium remains then white for about a week, and then slowly turns blue again. The medium is rendered strongly alkaline; it is to be noted that even during the period when the medium is white, it gives a strong alkaline reaction. It is difficult to explain the bleaching of the litmus milk though the reaction of the medium is still strongly alkaline as proved by putting a drop of the litmus milk culture on red litmus paper or using a solution of neutral red. Biologically bacillus Asiaticus Nos. 1 and 2 are probably not completely identical as the serum of patients in whom bacillus Asiaticus No. 2 was isolated agglutinated only partially or not at all bacillus Asiaticus No. 1, while it showed a strong agglutination for bacillus Asiaticus No. 2; moreover, in hyperimmunized animals there is no complete cross agglutination; but further researches are necessary on this subject having recourse also to other biological tests, such as the absorption method, &c.

Relation of the organisms described to other intestinal bacteria.

The following table will show the principal differential characters of various intestinal bacteria, and of the organisms observed by me.

TABLE SHOWING CULTURAL REACTIONS OF SOME KNOWN AEROBIC INTESTINAL BACTERIA, WITH NAMES ARRANGED IN ALPHABETICAL ORDER.

TABLE SHOWING CULTURAL REACTIONS OF SOME KNOWN AEROBIC

Abbreviations used in the table :—
A. = Acid. G. = Gas. C. = Clot. G.T. = General turbidity.
O. = Negative result, viz. :—Neither acid nor clot in milk, neither acid nor gas in sugar media,
+ = Positive result. ± = Sometimes positive,

Organism.	Motility.	Litmus milk.	Lactose.	Saccharose.	Dulcite.	Mannite.	Glucose.	Maltose.	Dextrin.	Raffinose.	Arabinose.
B. asiaticus. "*No. 1.*" (Castellani) ...	O.	O. Alk.	O.	A.G.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. asiaticus. "*No. 2.*" (Castellani) ...	O.	D. Alk.	O.	A.G.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. asylum dysenteriæ. "*8.*" (Eyre) ...	O.	O.	O.	O.	O.	O.	A.	O.	O.	O.	A.S.
B. asylum dysenteriæ. "*9.*" (Eyre) ...	O.	A. Alk. S.	O.	O.	O.	O.	A.	A.S.	A.S.	O.	O.
B. ærtrycke. (Van Ermengem)	+	A. Alk.	O.	O.	A.G.	A.G.	A.G.	A.G.	O.	O.	A.G.S.
B. acidi lactici. (Hüppe)...	O.	A.C.	A.G.	O.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. anærogenes. (Lembke)	O.	A.	O.	O.	O.	O.	A.	O.			
B. breslaviensis	+	A. Alk.	O.	O.	A.G.	A.G.	A.G.				
B. cloacæ. (Jordan.)	+	A.C.	A.G.	A.G.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. coscoroba	O.	A.C.	A.G.	A.G.	O.	A.G.	A.G.		A.G.	A.G.S.	A.G.
B. coli communis. (Escherich)	+	A.C.	A.G.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. capsulatus. (Pfeiffer)	O.	A.C.	A.G.	A.G.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. ceylanensis. (Castellani)	O.	A.C.	O.	O.	O.	O.	A.	O.	O.	O.	O.
B. cavicida. (Brieger)	+	A.C.	A.G.	O.	A.G.	A.G.	A.G.		A.G.	A.G.	A.G.
B. coli like. "Norman Hall"	+	A.	A.G.S.	O.	A.G.	A.G.	A.G.S.	A.G.		O.	
B. dysenteriæ. (Kruse-Shiga)	O.	A. Alk.	O.	O.	O.	O.	A.	O or A.S.	A.S.	O.	O.
B. dysenteriæ. "Flexner"	O.	A. Alk. S.	O.	O.	O.	A.	A.	A.	A.	A.S.	A.
B. dysenteriæ. "*Y.*" (Hiss and Russell)	O.	A.S. Alk. S.	O.	O.	O.	A.	A.	A.	A.	A.	A.
B. dysenteriæ. "Strong"...	O.	A.C.	O.	A.	A.	A.	A.	A.	O.	A.	A.
B. dysenteriæ. "Flexner" (Willmore, "El-tor.")	O.	A. S. Alk. S.	O.	O.	O.	A.	A.	O.	A.S.	A.S.	A.
B. dysenteriæ. "*Tor 22.*" (Willmore)...	O.	A.S. Alk. S.	O.	O.	O.	A.	A.	A.	O.	A.	A.
B. dysenteriæ. "*Tor R.H.B.*" (Willmore)	O.	A. Alk.	O.	O.	O.	A.	A.	O.	A.	A.	A.
B. dysenteriæ. "*Tor R.E.T.*" (Willmore)	O.	A.S. Alk. S.	O.	O.	O.	A.	A.	O.	O.	A.S.	A.
B. enteritidis. "*Original A.*" (Gaertner)	+	A. Alk.	O.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. enteritidis. "*Original B.*" (Gaertner)	O.	A. Alk.	O.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. epidemic jaundice	+	A. Alk.	O.	O.	O.	A.G.	A.G.	A.G.	?	A.G.	A.G.
B. Grünthal	+	A.C.	A.G.	O.	O.	A.G.	A.G.		A.G.	A.G.	A.G.
B. hog cholera. "Evans"...	+	A. Alk.	O.	O.	A.G.	A.G.	A.G.				
B. hog cholera. "Maryland." (Smith)	+	A. Alk.	O.	O.	A.	A.G.	A.G.	A.G.	A.G.	A.	A.
B. hog cholera. "McFadyean"	+	A.	O.	O.	O.	O.	A.G.S.	A.G.S.	A.G.S.	O.	A.G.
B. from infantile diarrhœa. (Duval, Baltimore.)	O.	A. Alk. S.	O.	O.	O.	A.	A.	A.	A.	A.S.	A.
B. icteroides. (Sanarelli)	+	A. Alk.	O.	O.	O. or A.	A.G.	A.G.	A.G.	A.G.	A.G.	A.
B. lactis aerogenes. (Escherich)	O.	A.C.	A.G.	A.G.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. levans. (Wolffin)	+	A.C.	A.G.	O.	O.	A.G.	A.G.		A.G.	A.G.	A.G.
B. moorsele	+	A. Alk.	O.	O.	A.G.	A.G.	A.G.				
B. mustelæ septicus.	+	A.C.	A.G.	O.	A.G.	A.G.	A.G.		A.G.	A.G.	A.G.
B. morgan. "*No. 1*"	+	O. Alk.	O.	O.	O.	O.	A.G. S.	O.	O.	O.	O.
B. morgan. "*No. 3*"	O.	A. Alk.	O.	O.	O.	A.	A.	A.	A.	O.	A.
B. morgan. "*No. 4*"	O.	A.S. Alk. S.	O.	O.	O.	A.	A.	O.	O.	A.S.	A.
B. neapolitanus. (Emmerich)	O.	A.C.	A.G.	A.G.	A.G.	A.G.	A.G.		A.G.	A.G.	A.G.

Intestinal Bacteria, with Names arranged in Alphabetical Order.

P. = Pellicle. S. = Slight. D. = Decolourised.
non-production of indole, non-motile or non-liquefaction of gelatine or serum as the case may be.
sometimes negative. $\frac{\text{A}}{\text{Alk.}}$ = Acid, then Alkaline.

Adonite.	Inulin.	Sorbite.	Galactose.	Laevulose.	Inosite.	Salacin.	Amygdalin.	Isodulcite.	Erythrite.	Glycerine.	Indole.	Voges-Prosk.	Redn. Nitrates.	Neutral Red	Gram.	Gelatine.	Serum.	Broth.	Peptone water.
O.	O.	A.G.	A.G.	A G.							+ S.	O.		O.	O.	O.	O.	G.T.	G.T.
O.	O.	A.G.	A.G.	A.G.							+ S.	O.		O.	O.	O.	O.	G.T.	G.T.
	O.	O.	A.S.	A.		O.	O.		O.		O.			O.	O.	O.	O.	G.T.	G.T.
	O.	O.	A.	A.		O.	O.		O.		O.			O.	O.	O.	O.	G.T.	G.T.
O.	O.	A.G.	A.G.	A.G.		O.					+ S.	O.			O.	O.	O.	G.T.	G.T.
A.G.	O.	A.G.	A.G.	A.G.	O.	O.			O.		+	O.	+		O.	O.	O.	G.T.	G.T.
											O.				O.	O.	O.	G.T.	
											O.				O.	O.	O.	G.T.	
O.	O.	A.G.	A.G.	A.G.	A. or O.	O.			O.		O.	+	+		O.	+	±	G.T.	
O.	O.	A.G.	A.G.	A.G.	O.	O.			O.		+	O.	+		O.	O.	O.		
O.	O.	A.G.	A.G.	A.G.	O.	O.			O.		+	O.	+	+	O.	O.	O.	G.T.	G.T.
A.G.	O.	A.G.	A.G.	A.G.	A.G.						±	+	+		O.	O.	O.		
O.	O.		O.	O.							O.			O.	O.	O.	O.	G.T., P.	G.T.
O.	O.		A.G.	A.G.	O.	A.					+	O.	+	+	O.	O.			
A.G.	O.		A.G.	A.G.							O.	O.		O.	O.	O.	O.	G.T.	
	O.	O.	A.	A.		O.	O.		A.S.		O.	O.		O.	O.	O.	O.	G.T.	G.T.
O.	O.	O.	A.	A.		O.	O.	O.	O.	O.	+	O.		O.	O.	O.	O.	G.T.	G.T.
O.	O.	O.	A.			O.	O.	O.	O.	O.	+			O.	O.	O.	O.	G.T.	G.T.
O.	O.	A.	A.			O.	O.	A.	O.	O.	+ +			O.	O.	O.	O.		
O.	A.	O.	A.			O.	O.	O.	O.	O.	+			O.	O.	O.	O.		
O.	O.	O.	A.			O.	O.	O.	O.	O.	+				O.	O.	O.		
O.	O.	O.	A.			O.	O.	O.	O.	O.	+				O.	O.	O.		
O.	A.	O.	A.			O.	A.S.	O.	O.	O.	+ +				O.	O.	O.		
O.	O.	A.G.	A.G.	A.G.		O.					O.	O.		+	O.	O.	O.	G.T.	G.T.
O.	O.	A.G.	A.G.	A.G.		O.					O.	O.		+	O.	O.	O.	G.T.	G.T.
	O.	A.	A.G.	A.G.							+	O.			O.	O.	O.	G.T.P.	
O.	O.	A.G.	A.G.	A.G.	O.				O.		+	O.	+		O.	O.	O.	G.T.	
											+ S.				O.	O.		G.T.	
		A.G.	A.G.	A.G.							O.	O.			O.	O.		G.T.	
	O.	O.	A.G.	A.G.S.		O.	O.		O.		+ S.				O.				
O.	O.	O.	A.	A.		O.	O.	O.	O.	O.	+				O.	O.	O.		
	O.	A.G.	A.G.	A.G.							+	O.			O.	O.	O.	G.T.P.	
A.G.	O.	A.G.	A.G.	A.G.	A.G.	A.G.					O.	+	+		O.	O.	O.	G.T.	
O.	A.G.	A.G.	A.G.	A.G.	O.	A.G.			O.		O.	+	+		O.	+			
											O.				O.	O.	O.	G.T.	
O.	O.	A.G.	A.G.	A.G.							+	O.			O.	O.	O.		
O.	O.	O.	A.G.S.	A.G.S.		O.	O.		O.		+ +	O.		+	O.	O.	O.	G.T.	G.T.
	O.	A.	A.	A.		O.	O.		O.		+ +								
	O.	O.	A.	A.		O.	O.		O.		O.								
O.	O.	A.G.	A.G.	A.G.	O.						+	O.	+		O.	O.	O.		

Organism.	Motility.	Litmus milk.	Lactose.	Saccharose.	Dulcite.	Mannite.	Glucose.	Maltose.	Dextrin.	Raffinose.	Arabinose.
B. oxytocus perniciosus. (Wyssokowitsch)	O.	A.C.	A.G.	A.G.	A.G.	A.G.	A.G.		A.G.	A.G.	A.G.
B. pseudo-dysenteriæ. "*A.*" (Kruse) ..	O.	A.	O.	O.	O.	A.	A.	O.	O.	A.	A.
B. pseudo-dysenteriæ. "*D.*" (Kruse) ...	O.	A.S. Alk. S.	O.	O.	O.	A.	A.	O.	A.S.	A.	A.
B. pseudo-dysenteriæ. "*D.*" (Kruse) ...	O.	A.S. Alk.	O.	O.	O.	A.	A.	O.	O.	A.	A.
B. para-typhosus. "*A.*" (Schottmüller)	+	A.	O.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. para-typhosus. "*B.*" (Schottmüller)	+	A. Alk.	O.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. para-colon. "*Day*"	+	A. Alk.	O.	O.	A.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. para-colon. "*Mair*"	+	A.C.	A.	O.	O.	A.G.	A.				
B. para-coli. "*Le Sage*"			O.	O.	A.G.	A.G.	A.G.	A.G.			A.G.
B. pseudo-coli. (Castellani)	+	A.C.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.S.	A.G.	A.G.
B. psittacosis. (Nocard)	+	A. Alk.	O.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. pneumonia. (Friedländer)	O.	A.C. ±	A.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
B. pyogenes fœtidus. (Passet)	+	A.C.	A.	A.	A.	A.	A.	A.	A.	A.	A.
B. proteus vulgaris	+	A.C.		A.G.	O.	O.	A.G.	A.G.			
B. suipestifer. (Kruse)	+	A. D.Alk.	O.	O.	A.G.	A.G.	A.G.	A.G.	O.	O.	A.G.S.
B. suicholeræ.	+	A. Alk.	O.	O.	A.	A.G.	A.G.	A.G.	A.G.	A.	A.
B. typhosus. (Eberth)	+	A. Alk.	O.	O.	O.	A.	A.	A.	A.	O. or A.	
B. wesenberg	+	A.	A.	A.G.	A.	A.	A.G.				
Bacilli Unnamed. No. 1. (Castellani)	+	A.S. D.Alk.	O.	O.	O.	A.	A.	O.	O.	O.	O.
No. 2. (Castellani)	+	O. Alk.	O.	O.	O.	O.	A.	O.	O.	O.	O.
No. 3. (Castellani)	O.	A.S. Alk.	O.	A.	O.	O.	A.	A.	A.	O.	A.
No. 4. (Castellani)	+	A.	A.	A.	A.S.	O.	A.	A.	O.	A.S.	O.
No. 5. (Castellani)	O.	D. A.C.	O.	O.	O.	O.	A.	O.	O.	O.	A.
No. 6. (Castellani)	O.	A.S. Alk.	O.	A.	A.	A.	A.	A.	A.	A.	A.
No. 7. (Castellani)	O.	A.C.	A.	A.	O.	A.	A.	A.	A.	A.S.	A.
No. 8. (Castellani)	O.	D. Alk.	O.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.
Vibrios :— *V. choleræ.* "*Saigon.*"	+	A.	A.	A.	O.	A.	A.	A.	A.	O.	O.
V. proteus. (Finkler J. Prior) ...		A.S.C.					O.				
V. zeylanicum (Castellani)	+	O.	O.	O.	O.	O.	O.	O.	O.	O.	O.

Adonite.	Inulin.	Sorbite.	Galactose.	Laevulose.	Inosite.	Salacin.	Amygdalin.	Isodulcite.	Erythrite.	Glycerine.	Indole.	Voges-Prosk.	Redn. Nitrates.	Neutral Red.	Gram.	Gelatine.	Serum.	Broth.	Peptone water.
A.G.	A.G.	A.G.	A.G.	A.G.	A.G.	A.G.			O.		+	+	+		O.	+ S.			
O.	O.	O.	A.			A.	O.	O.	O	O.	+ +				O.	O.	O.		
O.	O.	O.	A.			A.S.	O.	A.	O.	O.	+ +				O.	O.	O.		
O.	O.	O.	A.			O.	A.S.	O.	O.	O.	+ +				O.	O.	O.		
O.	O.	A.G.	A.G.	A.G.		O.					+	O.			O.	O.	O.	G.T.	G.T.
O.	O.	A.G.	A.G.	A.G.		O.					+ S.	O.		+	O.	O.	O.	G.T.	G.T.
		A.	A.G.	A.G.							+	O.			O.	O.	O.	G.T.	G.T.
											+				O.	O.	O.	G.T	G.T.
	O.	A.G.	A.G.									O.							
O.	O.		A.G.	A.G.							+	O.			O.	O.	O.	G.T.P.S.	G.T.
O.	O.	A.G.	A.G.	A.G.		O.					O.	O.			O.	O.	O.	G.T.	
A.G.	O.	A.G.	A.G.	A.G.	A.G.	A.G.			O.		O.	O.	+		O.	O.			
			A.	A.							+				O.	O.	O.	G.T.	G.T.
	O.		A.G.												±	+	+		
O.	O.	A.G.	A.G.	A.G.		O.					+ S.	O.			O.	O.	O.	G.T.	G.T.
		A.G.	A.G.	A.G.								O.			O.	O.			
O.	O.	A.	A.	A.		O.	O.		O.		O.	O.		O.	O.	O.	O.	G.T.	G.T.
											+				O.	O.		G.T.	
A.	O.	O.	A.	A.							O.	O.		O.	O.	O.	O.	G.T.	G.T.
O.	O.	O.	A.	A.S.							O.	O.		+	O.	O.	O.	G.T.P.	G.T.
O.	O.	O.	A.	A.							+	O.		O.	O.	O.	O.	G.T.P.S.	G.T.
O.	O.	O.	A.	A.							+	O.		O.	O.	O.	O.	G.T.	G.T.
O.	O.	O.	A.	O.							O.	O.		O.	O.	O.	O.	G.T.P.	G.T.P.
O.	O.	A.	A.	A.							+	O.		O.	O.	O.	O.	G.T.	G.T.
O.	O.	A.	A.	A.							+	O.		O.	O.	O.	O.	G.T.	G.T.
O.	O.	A.G.	A.G.	A.G.							+			O.	O.	O.	O.	G.T.	G.T.
O.	O.		A.	A.							+ +	O.	+	O.	O.	+	+	G.T.P.	G.T.P.
											+V.S.				+	+ +	+ +	G.T.P.	G.T.P.
O.	O.	O.	O.	O.							O.	O.		O.	O.	O.	O.	G.T.P.S.	G.T.P.S.

Conclusions.

1. In four cases of fever of obscure origin, and in which all the investigations for the usual infections, such as typhoid, paratyphoid, malaria, Malta fever, &c., remained negative, a bacterium was isolated which appears to be different from any other intestinal micro-organism.

2. Of this bacterium two varieties have been isolated which, for convenience sake, may be called bacillus Asiaticus No. 1 and bacillus Asiaticus No. 2. The first was found in two cases of long protracted, rather low, intermittent, and remittent fever, one of which harboured numerous anchylostomata. The fever did not cease after the anthelmintic treatment. Bacillus Asiaticus No. 2 was isolated from two cases which were at first considered to be cases of protracted typhoid, though the patients did not show any symptoms of enteric, there being no resolalœ, no enlargement of the spleen, and the Widal and all bacteriological investigations for typhoid and paratyphoid remaining completely negative. In one of these two cases there was a heavy ascaris infection, but the fever continued after the worms were got rid of. In both cases a symptom is worth mentioning, viz., the rather severe abdominal pains, lasting in one during the whole course of the disease, in the other being present during the later part of the malady and convalescence.

3. It would seem to me probable that bacillus Asiaticus No. 1 and bacillus Asiaticus No. 2 were the causative agents of these cases of fever, for the following reasons :—

(1) Presence of specific agglutinins in the patient's blood during the malady : agglutination slowly decreasing after the fever was over.
(2) The blood of the patients did not agglutinate any other micro-organisms.
(3) I have never observed bacillus Asiaticus No. 1 and 2 in the fæces of patients suffering from other diseases or in the stools of normal individuals.

Trichomycosis *Flava, Nigra,* and *Rubra* of the Hair of the Axillary Regions.

In individuals living in the hot, damp districts of Ceylon I have often observed an affection of the hair of the axilla somewhat resembling Pick's *Trichomycosis palmellina* of temperate zones. The hard nodules, however, as found in Pick's type, have always been absent in my cases; in these the hair presented formations plainly visible by the naked eye, which were of rather soft consistency, and easily removed by scraping with a triangular needle, or any such similar instrument. These formations are either yellow or black or, rarely, red; they may be very abundant, and form a yellow or black or red sheath round the hair. The same patient may have two varieties—very often the yellow and the black; in one of my patients all the hair of the right axilla were affected with the yellow variety, and all the hair of the left with the black; sometimes the same individual's hair may present some of the formations yellow and others black, or, rarely, red. All the three varieties on the same patient I have not yet observed.

The microscopic examination with a low power shows that the affected hair is covered at several places by roundish formations partially or totally encircling the shaft. Using a high power these masses will be seen to consist of enormous numbers of bacillary-like bodies in the yellow variety, while in the black and red variety, in addition to large groups of these bacillary bodies, masses of cocci-like organisms are present.

Stained preparations show that the bacillary bodies are occasionally branching, and very much resemble the thin mycelial articles of a streptothrix or a microsporoides. They are gram positive but not acid fast. The cocci-like organisms which are found in the black and red varieties are non-motile, and are gram positive. They are not acid fast.

Cultivation experiments.—The streptothrix or microsporoides-like fungus I have not succeeded in cultivating. The cocci-like bodies which are the cause of the peculiar black and red pigmentations I have been able to grow in pure cultures.

Culture characters of the coccus-like organism found in the black variety.—Sugar media are much more suitable for the growth of the organism than ordinary agar.

Sabouraud agar.—Colonies appear 24-48 hours after inoculation. They are roundish, at first white, but after a couple of days the centre of each colony turns black and this pigmentation slowly spreads excentrically. After a time the colonies coalesce together into a jet black mass.

Glucose.—Growth similar to sabouraud, but slightly less abundant; the black pigmentation develops from the centre of the colonies and slowly spreads towards the periphery.

Ordinary lab. agar.—Growth much less abundant than on most sugar agars and black pigmentation less marked.

Indol.—Most strains produce a trace of indol.

Levulose agar.—Identical to glucose.

Saccharine agar.—The pigmentation is less pronounced, and does not spread to the whole of the growth.

Raffinose agar.—Same as saccharine.

Lactose agar.—Scanty pigmentation.

Alkaline maltose agar.—Black pigmentation, well marked, though in many cases it does not extend to the whole of the growth.

Acid maltose agar.—Growth less abundant than on acid maltose, black pigmentation well marked.

Mannite agar.—As alkaline maltose.

Inuline agar.—As alkaline maltose, but pigmentation less pronounced.

Saccharose.—As inuline.

Glycerine agar.—Abundant growth, the whole of which, after a time, becomes of jet black colour.

Galactose.—As inuline.

Adonite.—Like acid maltose.

Serum.—Growth fairly abundant, but there is only a trace of pigmentation. The medium is not liquefied.

Gelatine.—No liquefaction; the growth on the surface shows after a time some dark pigmentation, but the colonies along the stab are white.

Milk.—No change.

Broth.—General turbidity; a thin pellicle is often present. The microscopical examination shows cocci arranged in pairs or irregularly; no capsule.

Peptone water.—Some growth at the bottom while the rest of the tube is clear.

Sugar broths.—No formation of acid or gas.

Culture characters of the coccus-like organism found in the red variety of the affection.—The coccus found in the red variety is more difficult to isolate and grow than the coccus observed in the black type of the disease. As a rule it grows better and shows more pigment on ordinary agar than on sugar media.

Agar.—The growth is at first white, then a red or red-yellowish spot appears in the centre. The pigmentation very slowly progresses towards the periphery, but in my experience never spreads to whole of the growth. On maltose and glucose agar the same pigmentation is present, but on most of the other sugar media no pigment is produced. Gelatine and serum are not liquefied. This coccus, as already stated, is gram-positive and non-motile.

Conclusions.

1. Trychomycosis of the hair of the axillary regions is common in Ceylon. Three varieties are met with : one yellow, one black, one red. The commonest are the yellow and black varieties.
2. The yellow variety is due to a bacillary-like fungus—probably a streptothrix or a microsporoides. This fungus I have been unable to cultivate.
3. The pigmentation in the black and red varieties is caused by coccus-like organism, which produce black and red pigment, and which grow in the hair in symbiosis with the bacillary-like fungus.
4. The black pigment-producing coccus is easily cultivated. It is apparently different from any other species of cocci known, and I suggest for it the term " Micrococcus nigrescens." The red pigment-producing coccus somewhat resembles *Micrococcus ruber*, of Trommsdorff, found in cases of chromidrosis. It also resembles *Microccus rubicus*, Hefferan; further investigation is necessary to see whether it is a separate species.

A new Species of Trychophyton.

This fungus was found in cases of peculiar *Tinea cruris*. The fungi so far found in Ceylon in this affection were :—

(1) Epid. Cruris (Cast. 1905), synonim. Epi, Inguinalis, Sabouraud, 1907.
(2) Epid. Perneti (Cast. 1907).

(3) Epid. Rubrum (Cast. 1909).
(4) Epid. Asiaticum (Cast. 1910).

To these may now be added the new fungus for which I have proposed the name of *Tr. nodoformans.*

Description of Tr. nodoformans, sp. n.

Microscopically the fungus has in the scales and in preparations from cultures the same appearance as other trychophytons; it is not very abundant in the lesions.

Sabouraud agar.—White powdery surface, central small knob, the growth deepens in the medium, and the submerged portions have a brick-red colour, which often disappears after repeated transplantations.

Glucose agar.—Growth somewhat more abundant than in Sabouraud agar. Colour of the surface and submerged growth white. Red pigment usually absent.

Maltose 4 *per cent.*—Scanty growth, no pigment.

Glycerine agar.—Growth fairly abundant, no pigment.

Agar.—Scanty growth, whitish.

Saccharine.—Same as agar.

Adonite.—Same as agar.

Pathogenicity.—The fungus gives rise to a peculiar type of *Tinea cruris* with very thick elevated margins and deep-seated nodules. It has pyogenic properties, and may spread to other parts of the body in addition to the inguinal regions. It is capable of affecting the hair follicles. In a case the fungus affected the hairs of the beard, producing a typical " kerion barbæ."

ALDO CASTELLANI.

No. 6.

EAST AFRICA PROTECTORATE.

THE ACTING GOVERNOR to the SECRETARY OF STATE.

(Received 4 March, 1911.)

Government House, Nairobi, British East Africa.
February 3rd, 1911.

SIR,

WITH reference to Sir Percy Girouard's despatch of the 1st September, 1910,* I have the honour to submit herewith the bacteriologist's report for the half-year ending the 31st December, 1910, together with a covering letter from the Principal Medical Officer.

I have, &c.,
F. J. JACKSON,
Acting Governor.

Enclosure in No. 6.

Principal Medical Officer's Office, Nairobi,
2nd February, 1911.

SIR,

I HAVE the honour to transmit the bi-annual report by the bacteriologist for the half-year ending December 31st, 1911. It is intended, as soon as the review of the work now nearing completion of the Nairobi laboratory—since its foundation—is published, to have subsequent reports printed for distribution.

The report shows that there has been an increase in the routine work over the corresponding period of last year, due chiefly to microscopic examinations and water analyses. Of the former, malaria shows no increase of cases despite an increase of material. A series of examinations for filariasis has been conducted on prisoners drawn from all parts of the country, with the result that it is probable that the greater portion of the country will be found free from it.

* No. 5 in Appendix VI in [Cd. 5514].

One microfilaria was found in a hyrax. The routine examination of cattle and stock slaughtered at the abattoir has been continued, with the result that 60 per cent. of the cattle and sheep are infected with sarcosporidiosis, the sarcocyst being, generally speaking, invisible to the naked eye. A giant form was found in a Grant's gazelle. Fortunately it is not a condition that has to be considered in its relationship to the consumption of meat.

Of the water analyses, the summarised results of the whole year are included for sake of convenience. The most important work undertaken has been the proposed water supply for Mombasa; it would really seem as if there was a possibility of a potable and adequate supply being obtained.

The preparation of glycerinated calf lymph has gone on uninterruptedly—3,916 tubes having been issued. A successful experiment was made with desiccated vaccine prepared according to the method of Marie Phisalix and Achalme; viable vaccine being introduced across the desert between Mount Kenia and the Abyssinian frontier, an exceedingly hot and waterless journey of some 14 days.

I have, &c.,
A. D. Milne,
Principal Medical Officer.

Secretary to the Administration,
Nairobi.

Bacteriologist's Report for the half-year ending 31st December, 1910.

Nairobi Laboratory, July-December, 1910.

The routine work of the laboratory has nearly doubled in amount during the last half-year. Excluding an increase—due to the examinations of slides for filariasis—the increase in the routine work is nearly 100 per cent. There has been nearly double the number of water analyses, due chiefly to an attempt to get monthly returns relating to the proposed supply for Mombasa. The samples brought by His Excellency the Governor from the Shimba Hills, and the samples from the same source forwarded since, were so good that it appears as if the question of water for a supply for Mombasa were settled. It would have been more satisfactory if samples had been sent monthly since His Excellency first discovered the source, as it is only by such examinations at regular intervals that the dependence or otherwise of the supply on the local rainfall, and consequently its uniform character or variations in purity, can be determined. There have, unfortunately, been gaps of months when no samples have been received for analysis, and the most that can be said is that there was no appreciable difference between the samples taken in July and those taken by Dr. Small in September.

Malaria.

Compared with the corresponding portion of last year there has been no increase in the number of cases of malaria diagnosed at the laboratory, and this in spite of the increase in the number of blood slides examined. It may, therefore, be said that there has been an actual decrease in the cases of malaria met. This is probably due to the fact that the small rains have been little more than half their normal amount, and that the fall was very evenly distributed and quickly absorbed by ground which had had much less than the usual amount of rain during the preceding big rains. The result of the failure of the big rains and then the comparative failure of the small rains would be that holes and puddles which formed breeding grounds in normal years have never got filled during the whole of the year 1910.

Among the material sent to the laboratory have been 164 blood smears from candidates for Government employment, the smears being sent for examination for presence or absence of signs of malaria. In five of these cases malarial parasites have been found (three subtertian infections and two quartan infections), and

in two instances pigmented large mononuclear leucocytes have been found. The great majority of these 164 subjects have been Indians. It is unlikely that the Indians concerned went up for a medical examination when they were feeling sick so that it is probable that the number found infected is not a fair index of the proportion infected among the general population, but that it is considerably below the true figure.

Filariasis.

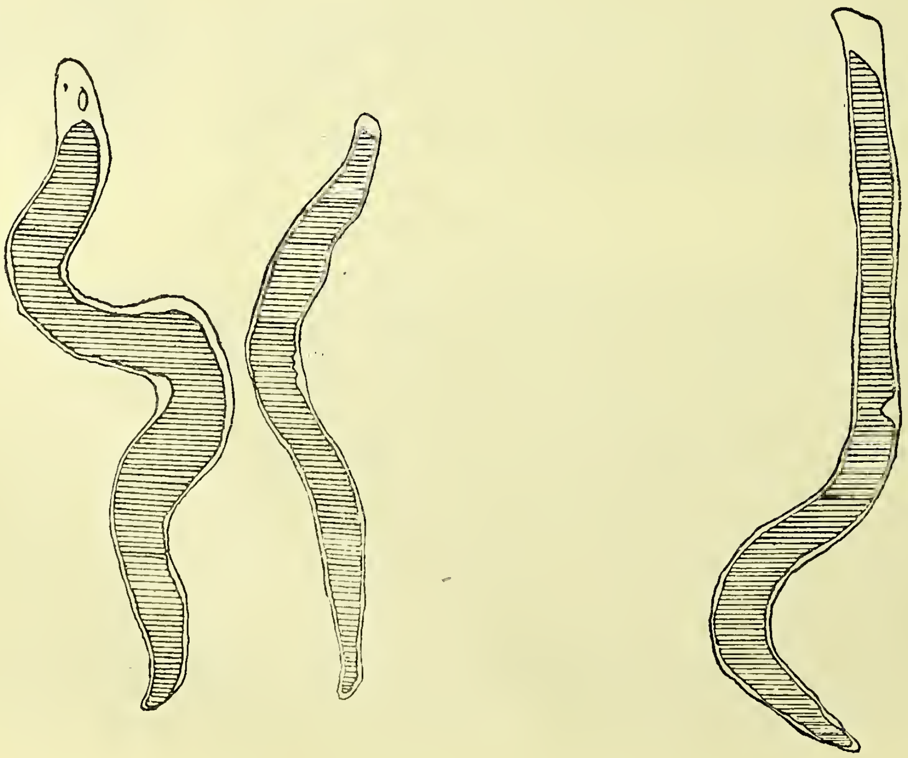
In my last report I described the finding among 200 prisoners of 2·5 per cent. infected with *F. nocturna* and 2·5 per cent. with *F. perstans*. During the past six months a larger series has been done, and it is possible to distribute the cases to their various tribes.

The blood smears were taken by Dr. Lowsley in the gaol between the hours of 9 and 11 p.m. Of the 423 smears taken eight (1·9 per cent.) showed microfilariæ. Only one of these showed *F. nocturna*, the other seven all showing *F. perstans*. Of the seven cases of *F. perstans*, two were Wakikuyu, one a Cazija, one a Swahili, one a half-bred Arab and Swahili, one a Mganda, and one a Nandi. The case of *F. nocturna* was a Nyao.

Considering the number of blood slides from the local native hospital examined during the past years, it is extraordinary that microfilariæ have been found in so few cases if many of the local Wakikuyu are infected. Although patients attending this hospital come from every tribe in the Protectorate, a majority of the cases must come from the Kikuyu country. Dr. Pritchard tells me that he has found a case of filariasis in a white woman who could only have been infected at Fort Hall, so that it is possible that there may be a focus of infection in that district. It is known that the Kavirondo country (round the lake shore) is highly infected, but it appears probable that the infection is absent in the country round Nairobi.

Microfilaria of Hyrax.

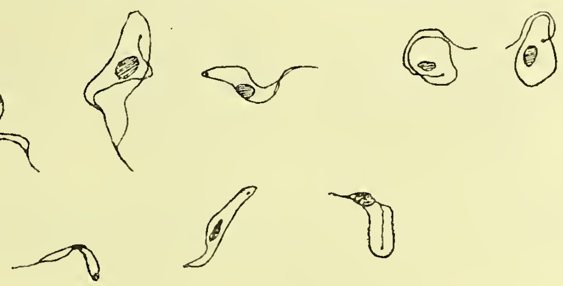
In a previous report I described the finding of microfilariæ in the blood of a hyrax. During the last six months this parasite has again been found, and drawings are now given. The embryo has no sheath, and a blunt-pointed posterior end. There is no complete break in the staining, but in some a V shaped clear spot is present about the middle of the parasite. In length the specimens measured were 60μ to 75μ in length.



Some Trypanosomes of East Africa.

Three separate trypanosomes have been studied during the past six months as regards their morphology, and also, so far as the supply of animals allowed, as regards their animal reactions. Besides these three, two others have been noticed, but it has not been possible to carry out any experiments with them. The original strains experimented with have been derived (1) from a dog naturally infected on Mombasa Island; (2) from a horse bought in Nairobi by Dr. Lowsley; and (3) from a monkey used to feed *Gl. pallidipes* on their arrival at the laboratory. These three are certainly distinct strains as shown both by their morphology and their animal reactions.

Trypanosome of the Dog, Mombasa Island.



A dog, belonging to the Provincial Commissioner, Mombasa, was found to be suffering from trypanosomiasis by Dr. Small, who most kindly inoculated two rabbits from it, and forwarded them to me. The originally-infected dog was almost certainly infected by the bite of *Gl. pallidipes*, which abounds on the island. *Gl. fusca* is found on the mainland close by, but in Dr. Small's opinion the infection was contracted on the island itself.

Morphology.

The most remarkable thing about this trypanosome was its polymorphism. The longest forms seen did not exceed 22μ in length, but every gradation between this long and rather slender form and almost circular forms, little larger than a red corpuscle, could be seen.

Although intermediate forms could be found, the majority of the trypanosomes seen could be divided into three groups :—(1) Long slender forms which showed 5μ–8μ of free flagellum. In these the posterior end was sharply pointed, and the centrosome some little distance from the point. (2) Medium-sized forms. These were most varied in size and shape. Most of them were very broad, and some were clearly in process of division, there being two nuclei and two centrosomes. Either no free flagellum, or only a short portion—2μ–3μ long—could be seen. It was often doubtful whether there was actually a short portion of free flagellum, or if the protoplasm of the parasite merely tapered off, leaving none of the flagellum free. The posterior end of the parasite was always much more rounded than in the case of the long forms, the point, when present, being much more blunt. The centrosome was never quite terminal, though often nearer to the extremity than was the centrosome in the long forms. (3) Round and tadpole forms. Less numerous than either of the other forms, but still frequently seen were forms which were either typically tadpole shaped or oval or circular. The latter were about the size of a red corpuscle, showed both nucleus and centrosome clearly, usually on opposite sides of the parasite. From the centrosome the flagellum could be traced to the edge of the parasite round which it then curved for some distance, finally becoming free of the parasite and projecting for about 5μ beyond the edge.

Locomotion. Locomotion was little marked. The parasites, though active, moved little about the field. It was rare for a parasite centred in the field to move out of sight even when watched for several minutes.

Animal reactions.

This trypanosome has been inoculated into rabbit, dog, monkey (Sykes' cercopithecus) sheep, rat, and goat. To all except the last it has proved fatal, and even the goat has not survived long enough for one to be able to say that it will not succumb.

The dates when trypanosomes were first found, and the duration of the disease, are as follows:—

——	Inoculated from.	Trypanosomes found.	Death.
Rabbit, No. 236	Original dog	7th day	36th day.
Rabbit, No. 237	Original dog	7th day	62nd day.
Dog, No. 239	Rabbit, No. 236 ...	Not found	7th day.
Dog, No. 248	Rabbit, No. 237 ...	7th day	23rd day.
Dog, No. 258	Rat, No. 253	28th day	22nd day.
Dog, No. 268	Dog, No. 255	9th day	21st day.
Monkey, No. 246 ...	Rabbit, No. 236 ...	9th day	31st day.
Monkey, No. 254 ...	Monkey, No. 246 ...	12th day	28th day.
Monkey, No. 266 ...	Dog, No. 258	7th day	16th day.
Monkey, No. 269 ...	Monkey, No. 266 ...	7th day	7th day.
Monkey, No. 271 ...	Monkey, No. 269 ...	6th day	35th day.
Monkey, No. 278 ...	Monkey, No. 271 ...	10th day	47th day.
Rat, No. 255	Dog, No. 248	10th day	47th day.
Sheep, No. 260	Monkey, No. 254 ...	12th day	66th day.
Goat, No. 280	Monkey, No. 271 ...	13th day	Alive 40th day.

TRYPANOSOME OF HORSE.

The horse from which this strain of trypanosome was obtained had been infected while out with a shooting party which started from Nairobi, that is to say, the infection could not have been contracted on the coast belt, where the dog became infected. It is impossible to say what fly conveyed the disease.

Morphology.

Like the trypanosome of the Mombasa dog, this trypanosome showed marked polymorphism. The longest forms were 18μ–20μ in length, and were often very broad. The smallest forms were 8μ–9μ long, and were slender. Every size intermediate between the long and short forms could be seen, and some medium sized forms were extraordinarily broad. But no oval or circular forms as seen and described in the dog trypanosome were ever found. In the longer, and also in some of the smaller, forms a short portion (3μ) of free flagellum could often be seen, but no specimens were seen showing as much free flagellum as did some of the trypanosomes from the dog. Nor did there appear to be any rule as to which specimens showed free flagellum, and which not. Some of the larger forms showed no free flagellum, and some of the smaller showed a small free portion.

The posterior end of the trypanosome was usually rounded. The centrosome was never quite terminal. In the large majority of the parasites the centrosome was close to one edge of the parasite a short distance from the posterior end. Most of the parasites showed chromatic granules often as large as, or larger than, the centrosome.

Animal reactions.

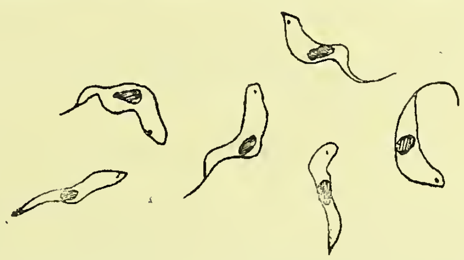
Attempts to infect a dog by inoculation of blood from the horse rich in trypanosomes failed, the dog living 101 days, and showing no signs of trypanosomiasis. Animals successfully inoculated were monkey, sheep, and goat. The number of days

after inoculation when trypanosomes were found, and the duration of the disease, were as follows:—

——	Inoculated from.	Trypanosomes found.	Death.
Monkey, No. 256 ...	Original horse	29th day	63rd day.
Monkey, No. 273 ...	Monkey, No. 256 ...	9th day	25th day.
Monkey, No. 279 ...	Monkey, No. 273 ...	16th day	16th day.
Monkey, No. 284 ...	Monkey, No. 279 ...	9th day	23rd day.
Sheep, No. 257	Original horse	29th day	79th day.
Goat, No. 263	Original horse	22nd day	31st day.
Goat, No. 283	Monkey, No. 273 ...	12th day	Alive 39th day.

Whereas, in animals infected with the dog trypanosome, parasites could usually be found and were plentiful, the horse trypanosome was always rather scanty. This scarcity probably accounts for the apparent prolonged incubation period in some of the animals.

TRYPANOSOME CONVEYED BY *Gl. pallidipes.*



A monkey on which *Gl. pallidipes* were fed on arrival at the laboratory showed such wasting and irregular temperature that a trypanosomiasis was suspected. But search for parasites in the blood always gave negative results even with the aid of the centrifuge until the day of the animal's death, when numerous trypanosomes were found.

Morphology.

Unlike the two trypanosomes already described, which showed variations in length between 8μ and 20μ, these trypanosomes were very uniform in length, being about 18μ long. Both broad and narrow forms were present. The undulating membrane was barely marked, but all showed a certain amount of free flagellum. In some it was only a portion, 1μ–2μ long, but in others free flagellum 6μ long could be seen. The centrosome was never terminal. The posterior end of the trypanosome was either rounded or pointed. The protoplasm showed no chromatic granules.

Locomotion.—Locomotion was no more marked than in the other two described.

Animal reactions.

Monkey (Sykes' cercopithecus) dog, goat, and sheep were inoculated with this trypanosome. The goat and sheep never showed infection, and sub-inoculation from the sheep to the monkey failed to produce an infection.

The following are the results of inoculation:—

——	Inoculated from.	Trypanosomes seen.	Death.
Monkey, No. 172 ...	Original monkey ...	11th day	Still alive (1 year).
Monkey, No. 250 ...	Monkey, No. 191 ...	9th day	Still alive (5 months).
Dog, No. 255	Monkey, No. 250 ...	6th day	6th day.
Sheep, No. 259	} No infection.		
Goat, No. 285			
Monkey, No. 283 ...	Sheep, No. 259	No infection.	

Trypanosomes were always exceedingly scanty in the blood of the monkeys. The dog showed high infection on the day of its death.

The failure of infection in the case of the sheep and goat is particularly interesting. In previous reports I have referred to the seasonal prevalence of the *Gl. pallidipes* at Kibwezi, and to the fact that the Makamba there move their cattle to the hills in August when this fly is due to reappear, giving as their season that the fly would kill their cattle. *Gl. fusca* is present in numbers at Kibwezi all the year round, but the natives pay no attention to it. Nor do they pay any attention to the effects of the *Gl. pallidipes* on their sheep and goats. If the trypanosome used in the above experiments is the only one conveyed by the Kibwezi (*Gl. pallidipes*), it is clear that the natives there have learned their wisdom by many years' experience, and it is very unlikely that that fly belt has ever been infected with a trypanosome fatal to sheep and goats. It will be of interest to inoculate cattle with this trypanosome, and so get experimental proof of the natives' statements.

Post-mortem.

In all three trypanosomiases the post-mortem changes were very various, and no distinction could be drawn after death between the animals which had died of the different strains of trypanosome. The spleen was sometimes enlarged, sometimes not; petechiæ on the lungs were invariably present; ulceration of the stomach was frequently, but not invariably, seen; œdema was never noticed; swelling of the glands was invariable, but trypanosomes could seldom be found in the gland juice.

Trypanosome Transmission Experiments.

Attempts at transmitting various trypanosomes by *Gl. fusca* have been continued. There was, unfortunately, some difficulty in getting an animal infected with *T. gambiense*, the result being that the experiment with this parasite could not be begun till December, and still continues. Negative experiments were carried out with *Gl. fusca* and a trypanosome from a dog at Mombasa, and *Gl. fusca* and a trypanosome conveyed by the *Gl. pallidipes* at Kibwezi.

Experiment 6.

Can one infect *Gl. fusca* with the Mombasa dog trypanosome?

Monkey No. 247 was used to feed flies on their arrival at the laboratory until sufficient had been collected for the experiment.

This monkey was bitten 124 times between August 11th and August 22nd. It died on September 29th, having shown no signs of trypanosomiasis, nor could any signs be found post-mortem.

Monkey No. 251 was used to feed the flies surviving from monkey No. 247.

This monkey was bitten 285 times between August 26th and September 15th (21 days). The animal is still alive, and shows no sign of trypanosomiasis.

Monkey No. 254 was infected with the dog trypanosome. It was bitten by flies surviving from Monkey No. 251 28 times between September 19th and September 22nd.

Flies that survived when feeding ceased on the infected monkey were starved for four days to exclude direct transmission, and then fed on experimental monkey No. 262. This monkey was bitten 175 times between September 26th and October 26th. The animal is still alive, and shows no signs of trypanosomiasis.

Conclusion.—In this experiment the animal on which the flies were fed for 21 days is still alive, and shows no infection, so that it is possible to exclude natural infection of the flies with a trypanosome transmittable to the monkey.

The trypanosome used in the experiment was rapidly fatal to monkeys, and always present in numbers in the peripheral blood. It is, therefore, certain that the *Gl. fusca* used in this experiment did not acquire an infection.

Experiment 7.

Can one infect *Gl. fusca* with the trypanosome conveyed in nature by the *Gl. pallidipes*?

Monkey No. 247 was used to feed flies until sufficient were collected for the experiment. It was bitten 357 times between August 24th and September 22nd. It died on September 29th, but showed no signs of trypanosomiasis during life nor post-mortem.

Monkey No. 261 was bitten 255 times during the 21 days September 26th to October 15th. This animal is still alive, and shows no signs of trypanosomiasis.

Monkey No. 191, infected with *Gl. pallidipes* trypanosome, was bitten by flies surviving from monkey No. 261 48 times between October 19th and October 21st. The surviving flies were then starved for four days, and then allowed to bite experimental monkey No. 270. This monkey was bitten 120 times between October 25th and November 23rd. The animal is still alive, and shows no signs of trypanosomiasis.

Conclusion.—As in experiment 6, the fact that the monkey on which the flies were fed for 21 days remains healthy excludes the possibility of the glossina used in the experiment being naturally infected with a trypanosome transmissable to the monkey.

The trypanosome used in the experiment is fairly easily found in an infected monkey, so that it appears that the flies used in the experiment were not able to become infected with this trypanosome.

Experiment 8.

This experiment with *Gl. fusca* and *T. gambiense* is still proceeding.

Sarcosporidiosis of Cattle and Sheep.

In my last report I drew attention to the large proportion of cattle killed at the Nairobi slaughter house found to be affected with sarcosporidiosis. Examination of material from all oxen slaughtered has been continued during the past six months with the result that 153 out of 249 oxen slaughtered have been found to be infected. It is probable that this percentage of infection (60 per cent.) is too low. Many of the smears received, although taken by cutting off the apex of the heart and smearing on a slide, have shown only blood, no elements from the heart wall being visible.

As during the previous six months, all the smears have been forwarded by Mr. Patrick, Sanitary Inspector, who has never found in any of the infected heart signs of infection visible to the naked eye.

I myself took and examined material from a series of sheep killed at the slaughter house, and in 37 out of 93 found spores of a sarcosporidium. As in the case of the ox, there was nothing that could be made out even with a hand lens. Smears of the heart's apex, however, showed spores indistinguishable from those found in the ox. Re-examination of a heart found to be infected by aid of the microscope always failed to show anything.

Examination of sections made from infected hearts showed thin-walled cysts similar to those already described in the ox.

Sarcosporidiosis of *Gazella granti.*

A hind-quarter from a Grant's gazelle was sent to the laboratory, and was found to be full of large cysts from $\frac{1}{4}$ inch to $\frac{3}{4}$ inch long. On examination the cysts were found to be densely packed with spores of a sarcocyst. The cysts were white in colour and oval or spindle shaped. Sections were cut, and it was found that there was a marked cyst wall apparently consisting of muscle fibres. The centre of the cyst showed no definite structure, but all round the periphery the spores were very distinct and stained well.

Examinations were made of a series of hearts of cases on whom post-mortem examinations were carried out at the native hospital. So far no case of human sarcosporidiosis has been found.

No. 7.

FEDERATED MALAY STATES.

THE ACTING HIGH COMMISSIONER to THE SECRETARY OF STATE.

(Received 3 June, 1911.)

SIR, Government House, Singapore, 8th May, 1911.

I HAVE the honour to transmit a report on the work done at the Institute for Medical Research, Kuala Lumpur, for the period from October 1st, 1910, to March 31st, 1911.

I have, &c.,
E. L. BROCKMAN.

Enclosure in No. 7.

REPORT of the Institute for Medical Research for the period October 1st, 1910, to March 31st, 1911.

BERI-BERI.

In previous reports it has been shown that beri-beri is intimately associated with the consumption of a diet of which white polished rice is the staple. It has further been shown that fowls, when fed on a similar diet, develop a disease closely analogous to beri-beri in its clinical appearances and pathological effects. These animals have, therefore, been used throughout this research to study the mode of operation by which a diet of white polished rice results in beri-beri in man.

The use of unmilled or unpolished rice, or the addition of rice meal or polishings to a diet of white polished rice, maintains fowls in health. It is concluded that substances of high physiological importance in the economy are present in the subpericarpal layers of the grain which are removed in the preparation of white rice in steam power mills.

Recent observations and experiments by scientific workers in China, French Indo-China, the Philippine Islands, and India have confirmed the accuracy of these observations as applied to human beri-beri.

The work in connection with this subject during the past six months has been concerned with further researches into the nature of the protective substances in the subpericarpal layers of the grain.

Previous experiments had shown that fats which are contained in the peripheral layers of the grain in comparative abundance are without value as a protective and that the phosphorus compound phytin (anhydroxo-oxymethylene-diphosphoric acid) in which form a large proportion of the phosphorus of rice is combined, is equally unimportant. It was shown, however, that the substances sought for were soluble in 0·3 per cent. hydrochloric acid, and were not precipitated from solution on the addition of alcohol in sufficient quantity to make the resulting mixture of proof spirit strength.

Following on the demonstration that the substances sought for were soluble in this proof spirit filtrate, experiments were undertaken with a view to isolating and testing the value of the various substances contained in that solution.

The solution was found to contain substances giving the reactions characteristic of protein. On increasing the alcohol content of the solution a precipitate was produced, and it was hoped that, by sufficiently increasing the alcohol content, all the protein would be precipitated.

A series of experiments in which the alcohol content of the liquid containing the protective substances was raised first to 83 per cent. and later to 91 per cent., showed that the effective substances were not precipitated from solution by this method, and that they were contained in the filtrate after treatment with 91 per cent. alcohol. This filtrate was a clear yellowish liquid.

In view of the fact that the protective substances are destroyed by exposure to steam under pressure, it was considered probable that the activity of the liquid was due, not to the presence of salts, but to the presence of organic compounds.

When the filtrate is freed from alcohol and the residue mixed with distilled water, a yellowish turbid liquid is obtained. On saturation with ammonium sulphate the liquid yields a reddish brown precipitate which gives the usual protein reactions. Half saturation with ammonium sulphate produces a slight precipitate.

Saturation with sodium chloride also produces a precipitate, and after filtration, saturation of the filtrate with ammonium sulphate gives a further precipitate. As many vegetable globulins are not precipitated until their solutions are nearly saturated with ammonium sulphate, it cannot be inferred that the alcoholic filtrate contains both a globulin and an albumin.

Unpolished rice was tested and found to contain alcohol soluble protein (prolamine) and white polished rice similarly tested was found to contain none. This is contrary to the observations of Rosenheim and Kajiura, but it seems probable that these authors did not examine unhusked rice, and that unpolished rice, not being an article of commerce in England, was not available.

The alcoholic filtrate was freed from alcohol, and the residue solved in distilled water. On heating this solution with phenylhydrazine hydrochlorate and sodium acetate, crystals of phenyl-glucosazone were obtained. Another portion of the liquid, after saturation with ammonium sulphate and filtration, gave a similar result.

The 91 per cent. alcoholic filtrate was evaporated to dryness, and the residue further dried in a desiccator. It was found to contain total solids amounting to 14·2 grammes from 100 grammes of sifted rice polishings. Gravimetrically it was determined that of this amount 29 grammes consisted of glucose, and by the Kjeldhal process that 2·08 grammes consisted of protein. The balance, 9·22 grammes, is assumed to consist of salts.

Attempts to separate the alcohol soluble protein by means of dialysis had to be abandoned on account of the growth of moulds and bacteria, despite the use of thymol.

Separation of the proteins was effected by precipitation with ammonium sulphate. The precipitate was solved in distilled water, and the fact that the proteins were so soluble suggests that they were not denatured. Fowls fed on white rice plus the alcohol soluble protein lost weight, and in one case polyneuritis developed. The filtrate, being saturated with ammonium sulphate, was useless for feeding experiments.

It was concluded that the alcohol soluble proteins contained in rice polishings are not by themselves sufficient to protect fowls from polyneuritis. This conclusion is based on the assumption that these substances were unchanged by the treatment to which they had been subjected.

In previous experiments it was shown that the protective substances contained in parboiled rice are extracted by treatment with hot—95 per cent.—alcohol, and it was thought possible that as polishings are in a much finer state of sub-division, agitation with 95 per cent. alcohol might suffice to extract the protective substances and leave the protein. Even by this method, however, both glucose and protein passed into solution; a similar result was obtained with absolute alcohol.

Experiments are now being undertaken to determine whether the protective substances can be separated from the ammonium sulphate filtrate or from polishings themselves by means of other solvents as, for example, ethyl acetate.

It may be that the 91 per cent. alcoholic filtrate contains substances other than protein, glucose, and salts, but until the various constituents of this liquid can be isolated, tested, and identified, the biological reaction remains the only method by which the presence of the protective substances can be identified.

A table is attached showing the distribution of the solids in the various fractions of rice polishings tested.

The researches in connection with the disease up to the present permit the following conclusions to be drawn:—

1. The occurrence of beri-beri in the Malay Peninsula has an intimate relationship with the consumption of a diet of which white polished rice forms the staple. Those who consume unpolished rice or slightly polished (native or Malay, or parboiled) rice do not suffer from the disease.

2. Fowls fed on white polished rice known to have been associated with outbreaks of human beri-beri develop a form of polyneuritis clearly analogous to beri-beri in its clinical manifestations and pathological effects. Other white polished rices produce a similar result. Fowls fed on unpolished rice remain healthy.

These animals may, therefore, be employed to study the mode of operation by which a diet of white polished rice results in beri-beri in man.

3. The estimation in terms of phosphorus pentoxide of the total phosphorus content of a given rice may be used as an indicator of the extent to which such a rice has been milled or polished, and therefore of its beri-beri-producing power when forming the staple of a diet in man.

4. The harmful influence of white polished rice is not due to the existence in it of a poison developed after milling. White polished rice makes default in respect of some substance of high physiological importance essential for the maintenance of health.

5. Fowls fed on white polished rice constantly develop polyneuritis in a period of three to four weeks.

6. If the meal or polishings removed from such white rice in the process of milling be added to a diet of white polished rice, fowls remain healthy.

Substances essential for the maintenance of health are, therefore, contained in polishings.

7. Unpolished rice which has been submitted to sterilization in the autoclave at a temperature 120° C. for two hours will cause polyneuritis when fed to fowls. The protective substances are destroyed under these conditions.

Methods of analysis involving exposure to high temperatures are, therefore, unsuitable for determining the nature of the protective substances.

8. The fats contained in the peripheral layers of the grain are of no value in protecting against polyneuritis.

9. The protective substances are soluble in 0·3 per cent. hydrochloric acid.

Phytin, which comprises 32·5 per cent. of the substances so soluble is without value as a protective.

10. The substances are not precipitated from solution in 0·3 per cent. hydrochloric acid on the addition of 95 per cent. alcohol in such quantity as to make the resulting mixture of proof spirit strength.

They are soluble in proof spirit containing approximately 0·12 per cent. hydrochloric acid.

11. The protective substances are soluble in a slightly acidulated solution containing 91 per cent. of alcohol, and, exclusive of glucose, amount to not more than 11·3 per cent. by weight of rice polishings, and not more than 1·13 per cent. of the original unpolished rice grain. In this fraction are included prolamine (alcohol-soluble protein) and compounds of calcium, magnesium, and phosphorus.

These researches, which comprise an unbroken sequence of experiments begining with rices associated with outbreaks of human beri-beri, demonstrate that rice is rendered harmful by the milling and polishing process to which it is subjected in the preparation of white polished rice. In this process there is removed from the grain some substance of high physiological importance in the metabolism, the absence of which results in the production of polyneuritis in fowls and of beri-beri in man when a diet is consumed of which white polished rice is the staple. Whether these substances act by rendering other elements in the diet available for nutrition, or whether they are themselves the nutritive materials necessary for nerve tissues, can, in our present state of knowledge, only be matter for conjecture. These substances, small in amount as compared with the total of the diet, have been determined within certain narrow limits, but their exact chemical nature is still unknown.

The researches further demonstrate that the minor constituents of food are equally as important as the major constituents, and that where the staple of the diet is a foodstuff such as white rice, which does not retain all the elements originally present in the grain, a varied as well as a sufficient diet is essential for the maintenance of health.

There is no evidence that white rice contains a poison generated after decortication by the action of moulds or other organisms.

As measures for the prevention of beri-beri in this country, it is recommended that the use of unpolished or under-milled rice be encouraged among those classes of the community in which the disease occurs. The polishing process, if carried out at all, should not extend beyond the removal of the outer skin or pericarp. The parboiling of rice before milling, as recommended by Dr. Braddon, serves the important purpose of so hardening the outer layers of the grain that their removal is less easy and over-milling is less likely to occur. The cooking of rice by steam under pressure should be prohibited. As an indicator of the extent to which rice has been milled, we recommend to chemists the use of the phosphorus pentoxide standard. In the examination of a large number of rices, none were found associated with human beri-beri or polyneuritis in fowls which yielded a phosphorus pentoxide content of 0·4 per cent. or over, as estimated on the undried material. The amount of moisture varied only slightly, and none of the rices were faced.

General.

Routine work in pathology and bacteriology has included the examination of tissues and other materials submitted by medical and veterinary officers, and the diagnosis of disease by laboratory methods.

Vaccines have been prepared from organisms isolated from various septic conditions and their employment has yielded satisfactory results in some cases.

Some attention has been paid to the study of the local anopheline mosquitoes and their breeding places, and it is proposed to undertake a systematic research in connection with this matter during the remainder of the present year.

Specimens of ticks and biting flies have been collected and forwarded to specialists in the different groups in England. We are greatly indebted to Professor Nuttall, F.R.S., of the University of Cambridge, and to Miss Ricardo, of the British Museum, for the identification of specimens and other information.

Dr. R. T. Leiper, Helminthologist to the London School of Tropical Medicine, has again kindly undertaken the identification of helminths from men and animals.

Routine work has fully occupied the time of the Government chemist, but where it was possible he has given assistance in connection with the research on beri-beri. An assistant chemist has recently been appointed, and this will enable some attention to be given to questions requiring special chemical investigation.

A. T. STANTON,
Acting Director, Institute for Medical Research,
Federated Malay States.

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100 grms. sifted polishings extracted with 0·3% HCl

- Passes into solution 26 grms.
  - On addition of 1½ volumes of 95% alcohol.
    - Precipitate (Phytin) 8·47 grms.
    - Filtrate 17·53 grms.
      - Freed from alcohol and to residue Absolute Alcohol added to make mixture of 91% strength.
        - Precipitate (inert) 3·4 grms.
        - Filtrate (active) 14·2 grms.
          - contains
            - Glucose 2·9 grms.
            - Protein 2·08 grms.
            - Salts 9·22 grms.
- Insoluble 74 grms.

No. 8.

FEDERATED MALAY STATES.

THE HIGH COMMISSIONER to THE SECRETARY OF STATE.

(Received December 2, 1911.)

SIR, Government House, Singapore, 8th November, 1911.

WITH reference to Mr. Brockman's despatch dated the 8th May, 1911,* I have the honour to transmit a report on the work done at the Institute for Medical Research, Kuala Lumpur, for the period from April 1st to September 30th, 1911.

I have, &c.,
ARTHUR YOUNG.

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* No. 7.

Enclosure in No. 8.

REPORT of the Institute for Medical Research for the period April 1st, 1911, to September 30th, 1911.

MALARIA.

The period under review has been marked by an unusually high incidence of malaria in all parts of the Peninsula. Special attention has, therefore, been paid to the factors determining the spread of this disease.

Anopheline mosquitoes breeding in the grass-grown edges of larger bodies of water, such as lakes and ponds, have been determined to be *Myzorhynchus barbirostris*, *Myzorhynchus sinensis*, *Myzomyia rossi*, *Myzomyia albirostris*, and *Nyssorhynchus nivipes*. In the smaller collections of fresh water, particularly the oozes and trickles from springs in ravines, *Neocellia willmori* and *Nyssorhynchus karwari* are the species usually found.

A large series of dissections of specimens of these species caught in nature has so far failed to reveal the presence of sporozoites in any species other than *N. willmori*. Considerable evidence has accumulated to show that *N. willmori* is probably the most important species with which we have to deal in many places. Feeding experiments with other species are now in progress to determine in which of these the parasites of malaria may develop.

Inquiry will be continued as to the species which transmit malaria in nature, and as to their habits and habitats. Measures to control the disease, if they are to be at once effective and economical, must rely upon the accuracy of this information.

It is a common observation in this country that, following the commencement of drainage works, an outbreak of malaria in the neighbourhood is not uncommon. In the course of construction works numerous small springs are exposed, and very soon these are found to contain larvæ; *N. willmori* and *N. karwari* breed freely in such situations. These conditions accompanied by the presence of a number of infected individuals employed on the works appear to be the explanation of what has hitherto been the usual course of events. In open concrete drains in which for any reason the flow of water has become impeded, anopheline larvæ have also been found. It is clear that the conditions created by inadequate drainage works are more potent for evil than streams or pools covered by secondary undergrowth, and that what are regarded as minor faults from the standpoint of the engineer are responsible for much of the ill success of measures undertaken for the control of malaria.

Examination of several hundred blood films taken from groups of coolies in various areas shows a large percentage of infections in persons showing no clinical signs of malaria. Maps have, therefore, been prepared showing the distribution of anopheline larvæ and of malaria infections in the different areas examined, and these, it is hoped, will be helpful to the executive authorities in the campaign against this disease.

MEDICAL ENTOMOLOGY.

The adults and larvæ of various species of anophelines are being systematically studied, and when a sufficient amount of material has been collected it is proposed to publish a revised account of the anophelines of the Peninsula for the use of medical officers and others interested in the matter.

Specimens of adult anophelines and larvæ have been exchanged with the Central Malaria Bureau of India with a view to eliminating some of the confusion which now exists in mosquito nomenclature, and to place the study of malaria in this country on a more satisfactory basis from the laboratory point of view.

Miss Ricardo, of the British Museum staff, has recently published in the " Indian Museum Records," " A revision of the species of Tabanus from the Oriental region," in which a large amount of material sent from this Institute is dealt with. Fourteen new species are described from the Malay States. Named specimens of many of these species have been presented to the Institute, and will form the nucleus of a reference collection for the use of veterinary officers. Material for a revision of other genera of the family Tabanidæ, Hæmatopota, and Chrysops, is now being collected.

BERI-BERI.

A special report on investigations concerning the etiology of this disease was issued in June. It was shown that the substances protective against the polyneuritis

of fowls and contained in rice meal or polishings are soluble in a slightly acidulated solution containing 91 per cent. of alcohol; exclusive of glucose the protective fraction amounted to not more than 1·13 per cent. of the original grain—in this fraction are contained protein and compounds of magnesium, calcium, potassium, and phosphorus.

In conjunction with Mr. Barrowcliff the researches in this subject have been continued, and results have been obtained which further narrow the field of inquiry.

The methods outlined in previous reports have been followed save that in the original extraction of polishings, distilled water instead of 0·3 per cent. hydrochloric acid has been employed.

Methods of precipitation based on the " salting out " principle having failed to separate the active substances, recourse was had to other methods of precipitation. Solutions of lead acetate and lead subacetate added to an aqueous alcoholic extract of polishings were first employed. It was found that the active substances still remained in solution after this treatment, and examination of the precipitates formed showed that they contained most of the phosphorus compounds and a large percentage of the nitrogen compounds originally present in rice polishings. It is improbable, therefore, that the physiologically active substance is a compound of phosphorus, as has been held by some workers on this subject.

Of the substances still remaining in solution after treatment with lead salts, a further portion was removed to throw down peptones in the solution. Biological tests with the products obtained were inconclusive, as the fowls developed symptoms of mercurial poisoning, owing, it is believed, to the formation of organic compounds of mercury which were not decomposable by sulphuretted hydrogen.

The line of research next adopted was to investigate the action of various organic solvents on the solution from which the lead precipitable substances had been removed.

For this purpose the substances held in solution in the protective fraction were dried on purified sawdust. By redissolving in distilled water it was demonstrated by feeding experiments that the physiological activity of the substances was unimpaired by this treatment.

The dried substances were, therefore, extracted from their admixture with sawdust by means of 94 per cent. alcohol, and this solvent was proved to dissolve the protective fraction. This solution was again desiccated on sawdust, which was then successively extracted with ethyl acetate, absolute alcohol, and water.

On applying the biological tests to the fractions obtained, the results suggested that the active principle was unequally distributed in the various fractions, the greater part being present in the ethyl acetate and watery extracts. Either then there are two substances present in rice polishings having a protective action against the polyneuritis of fowls or else a single substance existing in two forms of combination, the latter being the more probable explanation. On examination the ethyl acetate fraction was found to consist chiefly of organic acids, the free acids present in the aqueous extract of polishings, whilst the aqueous solution was found to contain magnesium and potassium salts of organic acids.

The possibility that the substance sought for was one of these organic acids naturally suggested itself, and the acids present are now being isolated, purified, and examined.

Water Supplies.

At the request of the Principal Medical Officer a series of examinations has been undertaken of the public water supplies of the Federated Malay States—these have included 60 chemical examinations and 19 biological examinations during the period under consideration. Data are being collected from which standards of chemical and bacterial purity for water supplies in this country may be formulated.

For the most part the public supplies have been found satisfactory, though in some few cases it has been necessary to recommend improvements in the purification methods.

Pathology and Bacteriology.

The routine work in these departments has been in the charge of Dr. Fletcher, who has also co-operated in the special inquiries in progress. Routine examinations have included the sero-diagnosis of syphilis and typhoid fever, the examination of material from suspected cases of plague, cholera, &c., the diagnosis of tumour and other tissues and the preparation of vaccines.

Dr. Fletcher also carried out a special inquiry in connection with rabies. Thirty-two brains from cases of suspected rabies were received at the Institute; twenty-nine were from dogs and one from man, one from a cow, and one from a cat.

Of the total examination nineteen were positive, eight negative, and five inconclusive owing to the condition of the material received.

No Negri bodies could be found in the human brain, which was that of a boy who developed rabies 40 days after being bitten by a dog. Two rabbits inoculated with this brain developed rabies, and in both these rabbits Negri bodies were found.

Negri bodies were found in the cat's brain, and the inoculation test was also positive. The examination of the cow's brain gave negative results.

In thirteen of the brains Negri bodies were found in fresh smears and later in the sections. In one case in which no bodies were seen in the fresh smear they were found in stained sections, and the result confirmed by animal inoculation.

In four of the cases where Negri bodies were found in the brain rabbits were also inoculated; in each of these cases the result of inoculation was positive.

In seven of the cases in which the result of microscopical examination was negative rabbits were inoculated, in two cases with a positive result. One of these was the human case mentioned above, and the other a case in which the brain was so broken and pulped that the *Cornu Ammonis* could not be found.

The brains of all inoculated rabbits were examined after death and Negri bodies were found in all the positive cases.

In these rabbits inoculated subdurally the incubation period was 16 or 17 days, except in one where symptoms developed on the 35th day. The average incubation period in the case of rabbits inoculated intra-muscularly was $37\frac{1}{2}$ days; in one case it was as long as 70 days.

Chemistry.

Mr. Hill, Government Chemist, reports that the routine work in this Department has increased greatly owing to the demands made upon it by the Health Branch, the Police Department, and the Chandu Monopoly. Increased accommodation has been provided by an addition to the present laboratory, and this will be ready for occupation in a few months. The total number of examinations carried out in this Department during the six months was 877.

During this period, Mr. Barrowcliff, Assistant Government Chemist, has made observations extending over several months on the effect of tropical sunlight as measured by the decomposition of oxalic acid in presence of uranium acetate. This is part of a general inquiry which is being carried out in different laboratories throughout the world at the request of the Bureau of Science, Manila. The results, which promise to be of great interest, will be communicated by Dr. Freer, Director of the Bureau of Science, at the forthcoming meeting of the Far Eastern Association of Tropical Medicine at Hong Kong.

Thanks to the courtesy of officers of the Forest Department, a collection has been obtained of native plants known or alleged to be poisonous, and chemical investigations of these will be carried out as opportunity offers.

A. T. Stanton,
Acting Director, Institute for Medical Research,
Federated Malay States.

No. 9.

FIJI.

The ACTING GOVERNOR to the SECRETARY OF STATE.

(Received 22 February, 1911.)

Sir, Government House, Suva, 17th January, 1911.

I have the honour to transmit, for your information, copies of reports presented by Dr. P. Bahr, M.R.C.S., L.R.C.P., of work done by him in his laboratory during the year 1910-1911, both in connection with his mission to Fiji on

behalf of the Tropical School of Medicine and as Honorary Pathologist to the Colonial Hospital at Suva. I caused a letter to be addressed to Dr. Bahr expressing this Government's appreciation of his work, and thanking him for presenting to the Colony his complete scientific equipment for the use of the Medical Department.

2. Dr. Bahr proposes to leave Fiji for England in the course of next month.

3. Owing to the present pressure of work in the local Government printing office, I have found it impracticable to have Dr. Bahr's full report printed, and although the Chief Medical Officer proposes to incorporate this report in his departmental report for the year 1910, it will be some time before that report can appear in print. Should the report be printed separately in England, I shall be obliged if you will cause me to be supplied with fifty copies for presentation to the Legislative Council, and for distribution among the local medical staff.

I have, &c.,
EYRE HUTSON,
Deputy Governor.

Enclosure 1 in No. 9.

Sir, Tamavua, Suva, Fiji, January 4th, 1911.

I have the honour to present you with a short account of the work performed in my laboratory during the year 1910-1911 and during my tenure of the post of Honorary Pathologist at the Colonial Hospital. A fuller account has already been presented to the Honourable Chief Medical Officer.

Dysentery.—Investigations have been made in nearly 150 cases. The germ believed to be the cause of the disease has been isolated some 24 times, and investigations made on its characteristics. The method of conveyance and dissemination has been traced to house flies, and they in all probability are the chief causes of dissemination here in Fiji. A number of cases of dysentery have been treated in various ways. Treated with certain new preparations, there has been but one death in the last 90 cases, making an extremely low mortality of 1·1 per cent. The occurrence of two forms of the disease, acute and chronic, in Fiji, due to different germs, has been established, and facts adduced as to the value of certain drugs in the latter.

Filariasis and Elephantiasis.—Over 1,500 blood examinations have been made, and strong evidence adduced for the production of elephantiasis by filaria worms. No less than 26 perfect specimens, male and female filaria worms, have been found and transmitted to England. The chief mosquito carrier of the filaria worm has been determined and its life history recorded, and the observations made in the destruction of mosquito larvæ by weak solutions of copper sulphate. It has been proved that the filaria of Fiji does not differ from that found elsewhere, but its habits have been altered by the mosquito carrier. Evidence of dead worms has been found in elephantiasis, which does much to reconcile the conflicting views previously held. The action of various drugs in the laboratory and in the human subject on the disease has been studied.

Miscellaneous.—A number of investigations of general interest have been made, and their results recorded in special reports. No less than 35 investigations on patients and specimens have been made for the Colonial Hospital and Medical Staff.

A number of observations have been made on the parasites occurring in the blood of birds and bats shot here.

In conclusion, I wish to record my gratitude for the kindness and assistance I have met at every hand, not only to the Chief Medical Officer, who has generously placed every opportunity at my disposal, but to a succession of Resident Medical Officers at the Hospital, to whom I never can be sufficiently thankful. The grant of £100 made by the Legislative Council for the furtherance of the work has been extremely useful, and I feel that the work and the results, such as they are, could not possibly have been performed had I not been given an official status, which not only myself but the school I represent was honoured to receive.

The provision of a Native Medical Assistant attached to my work has proved the greatest boon. For drugs and reagents, indispensable to a work of this nature, I have been supplied from the Pharmacy, without which, I need hardly say, the work

could not have proceeded. As arranged, I have left behind my full equipment to the Medical Department, representing a value of over £100.

I have, &c.,
PHILIP H. BAHR,
Hon. Pathologist (*pro tem*) to the Colonial Hospital, Suva.

To the Hon. Colonial Secretary.

REPORT BY DR. P. BAHR, M.A. (CANT.), M.B., B.C. (CANT.), M.R.C.S., ENG., L.R.C.P., LOND., D.T.M. & H. (CANT.), DELEGATE LONDON SCHOOL FOR INVESTIGATION IN FIJI.

To the HONOURABLE CHIEF MEDICAL OFFICER,

I have the honour to present you with the report of work done in my laboratory during the current year.

1. The objects of this enquiry, on which I was sent out by the Tropical School of Medicine, were as follows:—

(1) The investigation—bacteriological, pathological, and clinical—of the dysentery of Fiji.
(2) The investigation on the Pacific filaria, and the rôle played by it in the causation of elephantiasis.

Funds.—For this purpose a special grant of £500 was made by Lord Sheffield, supplemented by a sum of £300 from private sources, for the provision of laboratory assistance. At your kind suggestion, Sir, and that of the late Governor, Sir Everard im Thurn, a grant of a further £100 was made by the Legislative Council, and I was appointed Honorary Pathologist to the Colonial Hospital, both of which have proved the greatest assistance to me.

A free passage for myself and my assistant was given by the P. & O. Company to Sydney and free passages by the U.S.S. Co. from Sydney to Fiji.

Equipment.—The scientific equipment was the best that could be procured at a total cost of over £380 : a laboratory was set up on the verandah of this house.

2. The work performed and its results :—

(a.) *Dysentery.*

The methods of enquiry may be arranged under the following heads :—

(1) Bacteriological.
(2) Pathological.
(3) Clinical.
(4) Epidemiology.
(5) Amoebic dysentery.

(1) *Bacteriological.*—A bacillus giving the reactions characteristic of Shiga's bacillus has been isolated 11 times—twice post mortem, eight times from the stools, from Indians, Polynesians, and Fijians, and twice from the intestines of flies (*Musca domestica*) caught wild in the Dysentery Ward.

A bacillus giving the reactions characteristic of Flexner's bacillus has been isolated nine times, all from stools, for the most part from Fijians.

Abnormal dysentery bacilli have been isolated three times; they are probably of no practical importance, (*a*) because they are found in association with the true dysentery bacilli, (*b*) because they are (with one exception) not agglutinated by the serum of the patient from whom they were isolated.

Agglutination reaction occurs in the great majority of cases. The following points are noted : (1) it occurs only after the first week; (2) it lasts from six months to two years after attack; (3) patients suffering from an infection with Shiga's bacillus will agglutinate that bacillus more markedly than that of Flexner up to a dilution of 1:500.

(2) *Pathological.*—Post-mortems have been performed on nine cases of acute dysentery immediately after death; one case died of perforation of the large intestine.

Paintings were made to show the macroscopic lesions in almost every case.

The microscopic sections procured and studied show the process to be one of acute inflammation of the submucosa, and histologically quite peculiar. The bacillus has been recovered post-mortem.

(3) *Clinical.*—Clinical observations have been made daily on 145 patients up to date. Their condition has been noted daily and progress recorded. The first 55 recorded, and treated solely on routine lines with sodium sulphate. There were nine deaths, making a total mortality of 16·3 per cent.

Since April, 1910, patients have been treated by injections of antiserum, as proposed by the Lister Institute, and internally by means of cyllin enclosed in keratinized capsules, in addition to the routine treatment; since when there has been but one death in 90 patients; total mortality, 1·1 per cent.

The real death rate from acute dysentery in this country is hard to determine; Colonial Hospital records for the last six years place it at 12·8 to 5·3 per cent. On the Rewa in 1909 Dr. Montague had 236 cases with a mortality of 2·5 per cent., and again in March, 1909, an epidemic amongst the Fijians of 38 cases with a mortality of 25·7 per cent.

I venture to hope that you may consider the figures above given to be of some value.

(4) *Epidemiological.*—Circumstantial evidence points strongly to flies as being the means of conveying infection, for the following reasons :—

(1) Suva has a definite dysentery season, as evidenced by the records lasting during the hot months and corresponding with the fly season.
(2) The country districts, especially the sugar centres, Rewa, Ba, Lautoka, appear to have no special dysentery season, and flies swarm all the year round.

Direct evidence.—A paradysentery bacillus and Shiga's bacillus have twice been isolated from the intestinal tract of flies caught from the bed of a dysentery patient who exhibited both those bacilli in his stools.

Experiments are now being conducted to prove—

(*a*) the length of time a fly remains infective;
(*b*) the viability of the bacillus in sterile and unsterile water.

(5) *Amoebic dysentery.*—Seven undoubted cases of this variety have been observed. Numbers of amoebae have been noted in the stools. They were all of a relapsing, chronic nature; two occurred in Europeans. They all improved, and symptoms disappeared under treatment with ipecacuanha; one Indian had definite hepatitis and another hepatic abscess in association with dysentery.

Two post-mortems were made on subjects of this disease, and sections procured showing the amoebae *in situ* in the ulcers. An amoebic abscess in a Fijian without dysenteric symptoms was noted.

(b.) *Filariasis and Elephantiasis.*

All observations on microfilariæ in the blood-stream have been made with a measured quantity of blood, representing 15 cmm. The microfilaria present in the Fijians was at first supposed to be identical with that described as *Filaria philippinensis*, but that has not proved to be so. It has been proved to be identical with *Microfilaria nocturna*, of which several cases have been found in newly arrived coolies and Solomon Islanders who have worked in Queensland. The lack of periodicity has, by means of four-hourly observations, been confirmed in a great many cases, as first stated by Fleet Surgeon Thorpe, yourself, Sir, and Dr. Basil Wilson, and is proved to be constant in Fijians, Europeans, Indians, and Solomon Islanders resident here. The adult filaria has been found no less than six times : twice in subjects with microfilaria in their circulation, exhibiting no periodicity, and four times in those in whom no microfilariæ could be found.

They have always been found in or around a lymphatic gland, once in an abscess, twice in varicose groin glands.

The adult worm, of which no less than 26 perfect specimens, male and female, have been found, is identical with Filaria Bancroft. The transmission of the microfilaria has been worked out in four species of mosquito, namely, *Culex fatigans*, *Stegomyia fasciata*, *Stegomyia pseudoscutellaris* and *Taeniorhynchus fasciolatus.* It has been found to develop in *Culex fatigans* and *Stegomyia pseudoscutellaris*, but to perish in *Stegomyia fasciata* and *Taeniorhynchus.* Filaria nocturna has also been found to be transmitted by *Stegomyia pseudoscutellaris*, thus in all probability explaining the lack of periodicity and reconciling the identity of the two species and consequently disproving the validity of Filaria Philippinensis : the lack of

periodicity is then explicable by the fact that it is carried by a day-biting species (*Stegomyia pseudoscutellaris*) and a night-biting species (*Culex fatigans*).

Stegomyia pseudoscutellaris, which seems to be peculiar to the Pacific Isles, has been created a new species by Theobald. The transmission in *Stegomyia* proceeds to an extraordinary degree; all the microfilaria infested proceed to maturity; as many as 38 fully-developed filariæ have been taken from one mosquito; the infected mosquito has been demonstrated to be capable of re-infection. The entrance of the filariæ has been demonstrated to be through the skin, not by insertion by the proboscis of the mosquito, as formerly supposed.

In a great number of cases of elephantiasis and filarial disease the calcified remains of dead filariæ have been found, even in the epididymis and in hydrocele sacs. A remarkable degeneration of the lymphatic glands containing these remains takes place; they, too, have been found obstructing lymphatic vessels, which I take to be a factor in the production of elephantiasis and the frequent absence of microfilaria from the circulation in the latter disease. From statistics compiled from large numbers of figures obtained in various localities in these Islands, it has been proved the heavier the filarial infection of a place the greater the elephantiasis rate. Microfilariæ are found in 50 per cent. of cases of elephantiasis in this country. No microfilariæ have been found in any child under six years of age. The remarkable fact is brought out by these statistics, that those presenting the most marked features of filarial disease exhibit the fewest microfilariæ, while those that exhibit the most have few or no symptoms. The eosinophilia associated with filariasis has been found not to be affected by the presence of microfilaria in the circulation. An eosinophilia of 15 per cent. appears to be the normal status in Fijians, whether suffering from filariasis helminthiasis or no. Bacteria of suppuration have been found in association with adult filaria in the production of filarial abscess, and notably in those protracted cases of adenitis which eventually terminate in abscess of the hip joint or simulate a psoas abscess. In glands removed from these cases remains of filariæ have been found, together with these organisms : the lymph from lymphangitis due to the presence of filaria worms in the lymph glands has in every instance proved to be sterile, as has also the lymph taken from cases of lymphangitis occurring in a subject of elephantiasis. The microfilaria have on several occasions been observed to disappear within 24 hours from the circulation after attacks of lymphangitis, and their reappearance has also been watched. The outpouring of microfilaria into the tunica vaginalis has on three occasions been observed, and has been noted to be the probable cause of an attack of orchitis which occurred immediately after this observation. In other cases the microfilaria have been proved to be present in the lymphatic glands. Four post-mortems have been made on known subjects of filariasis. In one, the main seat of the microfilaria, as has also been found in filaria nocturna, has been seen to be the capillaries of the lungs. One post-mortem was secured immediately after an attack of filarial fever, and the filariæ were proved to be present in about every lymphatic gland surrounded by an area of pus, the intermittent absorption of which was in all probability the cause of the fever. A post-mortem on a case of elephantiasis of the scrotum has also been secured.

The action of various drugs in vivo and in vitro has been observed—neither atoxyl, antimony tartrate, nor quinine have been found to have the slightest influence on the numbers of microfilaria *in vivo.* In vitro antimony tartrate 1:10,000 kills the microfilaria in half an hour, but in the same strength of quinine and atoxyl they will live for several days. There apparently is no body elaborated in the sera of subjects of filarial infections which is inimical to the microfilaria, so they probably exert no toxic action; in sterile chambers they have been kept alive nine days in sera taken from normal Europeans, sera from elephantiasis cases, and from cases during an attack of filarial fever.

The conclusion arrived at is that the elephantoid state represents the reaction and expression of the human body to hyperfilariation. Numerous observations have been made on the life history of *Stegomyia pseudoscutellaris,* the most important carrier of the filaria. It has been found that in hot weather the complete cycle from ovum to imago occupies but a week; furthermore, they will breed in brackish, as well as fresh, water, or in water containing algae and microscopic life or none at all; they have even been reared in sterile water containing sterile grass. Their chief food supply seems to be the decaying vegetation. The action of copper sulphate on the larvæ has been tested on the strength of grs. 1 to gallon; the larvæ hatch, but immediately die. Older larvæ if placed in such a solution cease to develop, and eventually die of

starvation. They do not develop in salt water. Blood of some sort seems to be essential to the life of the imago; they fail to thrive on fruit, sugar, jam, or bananas, as do other species. The females do not lay eggs till they have fed on blood. They feed daily on blood if permitted. Their blood-thirst habits then constitute a fresh danger. They feel well during the daytime, but better towards dusk, and not at all at night time.

Miscellaneous.—A great number of examinations of stools in different institutions has been made from time to time to determine the frequency of intestinal parasites amongst the Fijians, and the results have been communicated to you, Sir. Over 300 have so far been done. Post-mortems have been made on cases of interest. Several severe cases of ankylostomiasis, acute yellow atrophy of the liver, tubercular disease of heart, hæmopericardium, as associated with extreme fatty degeneration of the heart, &c., and several very interesting post-mortems on dogs dead of filaria immitis. Some observations have been made on acute conjunctivitis (Cika), and a small diplobacillus has been cultivated on blood agar from the pus. An interesting case of probable blastomycosis of the skin in an Indian yielded interesting sections. Some observations have been made on the leucopenia associated with dengue fever. The blood of 15 species of birds has been examined, and unsheathed microfilaria found in two species. The blood of two kinds of bats has also been examined, and in the flying fox, or fruit bat, an endocorpuscular parasite resembling the malaria parasite occurs in great profusion. The slides make beautiful specimens. The probable carrier has been found to be an Ecto parasite, which occurs sparsely on these bats and is peculiar of the genus nycteribyda.

A considerable amount of work has been executed for the Colonial Hospital and Medical Staff of the Colony, of which the following is an approximate list :—

1. *Widal reaction* of European patients : stool examination—dysentery.
2. Blood count and Widal reaction on private patient, dengue.
3. Blood count and Widal reaction on Japanese, typhoid.
4. Microscopic diagnosis of gonorrhœa and gonorrhœal ophthalmia.
5. Section of tubercular gland, for Dr. Smalley.
6. Section of epithelioma, for Dr. Hall.
7. Stool examination, European dysentery patient.
8. Widal reaction in case of (?) typhoid.
9. Section of epithelioma of penis—Dr. Smalley.
10. Investigation of two Solomon Islanders' blood and stools, for Dr. Smalley.
11. Sputum examination, three occasions.
12. Section of infant's stomach, for Dr. Hall.
13. Investigation of tubercular stricture of rectum, for Dr. Smalley.
14. Post-mortem of Fijian, dead of hæmatemesis.
15. Section of breast tissue (private patient), Dr. Smalley.
16. Post-mortem of case of (?) cerebral hæmorrhage.
17. Section of diseased meat, for Dr. Smalley.
18. Section of mammary tumour, for Dr. Hall, Ba (private patient).
19. Vaccine treatment, case of diffuse suppuration; five injections. Successful.
20. Post-mortem on Indian (police case). Case of carbonic acid gas poisoning.
21. Sputum examination for tubercle bacillus.
22. European with amœbic dysentery. Stools examined.
23. Vaccine treatment on patient sent by Dr. Harper.
24. Post-mortem on Indian woman. Carcinoma of suprarenal.
25. Vaccine treatment furunculosis of chin. Successful.
26. Stools of Indian examined for trematode ova.
27. Urine of European patient examined for tubercle bacillus and gonococcus. Vaccine prepared.
28. Post-mortem on Indian found dead.
29. Complete blood examination of European patient.
30. Nasal mucous of leper examined. Diagnosis confirmed.
31. Sputum examined for tubercle bacillus.
32. Intraspinal injection of magnesian sulphate and antiserum in tetanus.
33. Vaccine treatment of case of chonic axillary abscess. Successful.
34. Post-mortem of Fijian woman with hæmopericardium.
35. Examination of nasal mucous of suspected leper. Negative.
36. Widal reactions in typhoid epidemic at Nadroga.
37. Widal reaction on six patients with typhoid in Suva.

Conclusion.—In conclusion, I wish to express my gratitude not only for the monetary assistance given, but also for the provision of a Fijian student, who has been of the greatest possible assistance to me, both in the wards and in the laboratory. Moreover, I have been granted drugs and reagents from the Pharmacy from time to time as my own stock has given out. Thus, I have had absolute alcohol, ether, cotton-wool, hydrochloric and sulphuric acids, copper sulphate, atoxyl, and quinine on various occasions.

I should also like to record my gratitude for the kindly spirit in which I have been assisted by many officials : to you, Sir, for your advice, assistance, and encouragement, to Drs. Prideaux, Smalley, and Smartt, who, at the Colonial Hospital, have ever been willing to assist me in any way in their power, and to the nursing staff of the Colonial Hospital, who have aided me considerably in observations on patients and in taking specimens of blood during the night time.

I have, &c.,
PHILIP H. BAHR.

January 2nd, 1911.

No. 10.

FIJI.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received 8 August, 1911.)

SIR, Government House, Suva, Fiji, 27th June, 1911.

I HAVE the honour to forward herewith, for your information, a report by the Chief Medical Officer on an outbreak of dengue fever in Suva.

2. I am informed that these outbreaks of dengue fever are of a recurrent nature, and that the people more severely affected by it are new arrivals in the Colony. In the case of older residents, its symptoms are usually considerably modified.

3. I understand that the theory in regard to this disease is that it originates and is transmitted by means of mosquitoes. With a view to its mitigation and the extermination, so far as is possible, of mosquitoes, the Health Authorities of Suva, in conjunction with the Municipal Council, are at present, and have for some time been, engaged in clearing and forming drains in and around the town of Suva. The improving of existing watercourses and the draining of swampy and improperly drained portions of land are at present being carried out by a small gang of prisoners under the supervision of a European overseer.

4. With a view to arriving at conclusions as to the cause of the disease and the mosquitoes by which it is transmitted, the Medical Officer of Health is at present making an investigation. His report, when received, will be forwarded for your perusal.

I have, &c.,
F. H. MAY.

Enclosure in No. 10.

SIR, Medical Department, Suva, 9th June, 1911.

IN reply to the direction of His Excellency the Governor, I have the honour to report on the present outbreak of dengue fever in Suva.

I have been assisted in my report by replies to my questions from Dr. Fox and Dr. Stibbe, of Suva, who were kind enough to answer questions on the symptoms that they have observed, and the apparent date of the beginning of the present outbreak, and by a report from the Resident Medical Officer, Colonial Hospital.

It should be said that the epidemic still continues, though perhaps the worst of it is now over, for the reason that possibly most people have already suffered.

Date of the outbreak.

2. The present outbreak appears to have begun to be epidemic about the fourth week of April. There is no doubt that cases have cropped up from time to time earlier in the year and during 1910 and 1909. In those years though there was no marked epidemic, there were in the Colonial Hospital many cases, some of quite marked severity and very often among newcomers.

Dr. Stibbe reports about April 24th as the beginning, though he had seen four cases in two previous weeks; three of these cases were not residents of Fiji.

Dr. Fox reports his first case on May 2nd.

Dr. Smartt, from Colonial Hospital records, gives April 22nd as the date of the first admission.

Locality.

3. The entire town and surroundings of the town of Suva have been affected, no part has been exempt; and reports are that there have been a great many cases in the Indian settlements at Samabula, Toorak, Muanikau, and Muanivatu. The gaol, however, does not appear to have begun to suffer until later. The Visiting Medical Officer considers that the infection may have been carried through the warders by night mosquitoes, as the disease in the gaol first showed itself among the warders, who are often in Suva at night, and only later among the prisoners, who are, of course, confined at night. The first cases at the gaol seem to have occurred about a week ago, and at present there are six admissions to Colonial Hospital from the gaol.

Number of cases.

4. It is impossible to give anything like an accurate enumeration of cases, because, in my opinion, by far the greater number of people have had the disease very mildly; some have not gone to bed at all, some have done so perhaps for one day (this perhaps has been the case amongst those who have had former attacks), and a very great number have had no medical advice or hospital treatment, and there is, therefore, no record of them.

Dr. Fox, on May 20th, reports 21 cases.

Dr. Stibbe reports 79 cases in four weeks in all races and in all parts of Suva and its neighbourhood; in the four weeks his cases were 13, 18, 27, 21.

Colonial Hospital returns show 58 cases from 22nd April to 5th June, of which 46 were Fijians (25 constabulary).

That the epidemic has been universal is shown by the fact that the employees at various business houses have been laid up in such numbers that, in some cases, business was for a few days carried on with difficulty, and storekeepers report that for a time they noted a marked diminution in the numbers of their customers.

Severity of the disease.

5. All are, I think, agreed that the attacks have been for the most part mild—there may have been a few severe cases here and there, but in most the symptoms have been far less severe than in former years, and, though lacking none of the unpleasantness that we all know so well, have been practically well in three or four days.

A typical attack of dengue fever begins with a high temperature, agonising pain in the back and limbs and severe headache, the temperature may be accompanied by a rash on the face, neck, and chest, with even swelling of the face and neck to an alarming degree; the temperature remains high for four or five days or even a week, and then rapidly falls to normal, where it remains for 24 or 36 hours, to be followed by a rapid rise to a considerable height for a short time up to 24 hours. There is then a final fall, with copious sweating, and a secondary eruption followed by peeling, and all the unpleasant irritations of skin, depression of spirits, aching of eyeballs, general debility, fainting, slow pulse, and possibly diarrhœa.

Several isolated severe cases of this type were seen in 1910 and 1909, notably in newcomers, and some were so severe as to show a marked likeness to enteric fever at the end of a week, when the sudden cessation came.

In the present epidemic all the symptoms are modified, the rash is not so marked, fever lasts for two days (Stibbe)—two days (Smartt). Headache and backache have not been so severe as they have been noted in former years, convalescence has been much more rapid, and after effects less markedly unpleasant; but many cases, in spite of being mild, have been quite typical, with initial and secondary rash, pain and fever of a few days' duration accompanied by a short secondary rise.

6. A reply of the Medical Officer of Health is attached. He is now engaged in investigations into the cause of the disease and its possible conveyance by mosquitoes.

I have, &c.,
G. W. A. Lynch,
Chief Medical Officer.

P.S.—Since writing the above report, there have been many more cases from the gaol and one or two cases of fairly marked severity in the Colonial Hospital.

The Honourable
Colonial Secretary.

Sir, Public Health Laboratory, Suva, 22 May, 1911.

I have the honour to acknowledge the receipt of your letter of 18th instant.

I note the instructions contained therein and will endeavour to carry them out so far as is possible in the time not taken up by routine and other work at present in hand of which you are aware.

I have so far been unable to do any work at dengue fever, but I will report from time to time to you on any work done by me in this disease.

I have, &c.,
Archibald Ireland,
Medical Officer of Health.

The Honourable
The Chief Medical Officer.

No. 11.

JAMAICA.

The ACTING GOVERNOR to the SECRETARY OF STATE.

(Received 2 June, 1911.)

Sir, King's House, Jamaica, 10 May, 1911.

I have the honour to transmit to you herewith, copies of minutes addressed to the Superintending Medical Officer by the Medical Superintendent of the Lunatic Asylum in this Colony, relative to the prevalence of "pellagra" in Jamaica, and also the photographs* of cases of the disease in the lunatic asylum.

2. If it meets with your approval, I shall be obliged if copies of these minutes and the photographs may be sent to the Committee which was appointed in London last year for the purpose of dealing with this disease.

I have, &c.,
P. C. CORK,
Acting Governor.

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* Not reproduced.

Enclosure 1 in No. 11.

MINUTE by the MEDICAL SUPERINTENDENT, Lunatic Asylum, to the SUPERINTENDING MEDICAL OFFICER.

The Asylum, Kingston,
23rd June, 1910.

Pellagra.

ACTING SUPERINTENDING MEDICAL OFFICER,

I HAVE the honour to report, for the information of His Excellency the Governor, that a telegram dated May 13th from Dr. Sambon, now in Italy in charge of the Pellagra Field Commission, conveyed the information that the Commission has definitely proved that maize is not the cause of pellagra; the parasitic conveyor is the *simulium reptans*. This information confirms the clinical observations made in this institution some time ago.

In last year's report I made the following reference to this disorder and the effect upon it of the exclusion of maize from our diet:—

> "In continuation of my note in last year's report on pellagra, a nervous disorder, due, it is believed, to the consumption of damaged maize, the attempt made to eradicate the disease by the substitution of bread, sugar, and fruit for cornmeal has proved but a partial success. There was an undoubted diminution of the number of cases in our wards, *but as several new cases occurred long after the withdrawal of the cornmeal, I am not satisfied the condition is entirely due to the consumption of damaged maize* and propose restoring, though to a limited extent, the cornmeal rations."

I am, &c.,
D. J. WILLIAMS,
Medical Superintendent.

Enclosure 2 in No. 11.

MINUTE by the MEDICAL SUPERINTENDENT, Lunatic Asylum, to the SUPERINTENDING MEDICAL OFFICER.

The Lunatic Asylum,
March 31st, 1911.

Hon. SUPERINTENDING MEDICAL OFFICER,

I HAVE the honour to ask that you would be good enough to submit to the Government the enclosed photographs of the disease "pellagra" met with in this institution, and, if the Government approves, for transmission to the Right Honourable the Secretary of State for the Colonies.

Owing to the recent discovery of the prevalence of this disease in certain British Colonies, and in the United States of America, an Investigation Committee was appointed in London last year for the purpose of elucidating the etiology of the disease.

Dr. Sambon, Lecturer to the London School of Tropical Medicine, with several assistants, proceeded to Italy—where the disease has been prevalent for many generations—carried out certain investigations, and made an interim report.

Dr. Sambon writes:—So far I have been able to establish—

(1) That pellagra is not due to the eating of maize, either sound or deteriorated, as hitherto almost universally believed.

(2) That it has a striking, peculiar, and well-defined topographical distribution.

(3) That its endemic foci or "stations" have remained exactly the same in many places for at least a century.

(4) That its stations are closely connected with streams of running water.

(5) That a minute blood-sucking fly, of the genus simulium is, in all probability, the agent by which pellagra is conveyed.

With reference to the 4th conclusion I may point out that there are no streams of running water in the vicinity of this asylum, but we are on the foreshore of Kingston harbour and at certain seasons sand-flies abound.

I have, &c.,
D. J. WILLIAMS,
Medical Superintendent.

Enclosure 3 in No. 11.

MINUTE by the MEDICAL SUPERINTENDENT, Lunatic Asylum, to the SUPERINTENDING MEDICAL OFFICER.

The Asylum, Kingston,
Hon. SUPERINTENDING MEDICAL OFFICER, April 20th, 1911.

IN compliance with the suggestion of the Government I have the honour to make the following further remarks on the prevalence of pellagra in Jamaica.

The disease although well known in the countries bordering on the Mediterranean Sea, due it is believed to the ingestion of maize which had undergone some form of deterioration, was not recognised in the Western Hemisphere until within recent years.

In November, 1909, the first National Conference on pellagra was held under the auspices of the South Carolina State Board of Health at the State Hospital for Insane, Columbia, South Carolina.

An invitation was extended me to take part in the proceedings and read a paper on my experience of the disease in Jamaica.

Owing to ill-health I was unable to take advantage of the invitation, but submitted a short history of the disease as met with in the Institution, which was subsequently published in the transactions of the Conference.

Amongst other things it was reported :—

(1) The existence of pellagra had been recognised in our wards for the past twelve years, but as the disease was unknown in the West Indies the correctness of the diagnosis was questioned, and the erythematous condition of the exposed parts of the body attributed to sunburn.

(2) The disease was always met with in aged, feeble, and listless inmates who might possibly have suffered from sunburn, but as symptoms of the disease were observed in other cases not exposed to the direct rays of the sun, it was concluded the former diagnosis of pellagra was correct.

This has since been amply confirmed.

(3) Five years ago the disease was very prevalent in our wards; 4 per cent. of the inmates—male and females in about equal numbers, in a population of 1,050—were attacked. With rest in bed and a generous diet, the majority of the cases improved temporarily, others made no improvement, but suffered from progressive weakness and emaciation until some intercurrent disease ended the scene.

(4) As already pointed out in the reports of this Institution, maize and its various preparations were rigidly excluded from our diet for 12 months for the purpose of ascertaining if the damaged maize theory of the etiology of the disease had any foundation in fact.

Finding that cases admitted after the exclusion of the cornmeal preparations from our diet suffered from the disease, the opinion was then formed that maize was not the sole cause; indeed, so confirmed was I in this opinion that I requested the National Conference of South Carolina to place on record my belief that maize—damaged or otherwise—was not the sole cause of pellagra.

It afforded me no small amount of pleasure to find this opinion confirmed by such an eminent authority as Dr. Sambon, who, in the "Progress Report on the Investigation of Pellagra," writes he has been able to establish the disease was not due to the eating of maize, either sound or deteriorated, as hitherto had been universally believed.

Dr. Sambon points out that some of the older writers on the disease in Italy ascribed the disease to eating polenta without salt. On the

strength of this unfounded etiological view the Government distributed free salt as a prophylactic measure. This information is instructive as I believed the salt fish rations and the excessive consumption of salt by the peasants of Jamaica might have been an etiological factor of the disease.

This theory is now finally disposed of, as the absence of salt in one country and the excess of it in another part of the world is not likely to be an etiological factor of the same disease; in other words, there is no connection between the presence or absence of salt and the disease.

(5) That there is an intimate connection between the disease and insanity admits of no doubt; the majority of recorded cases in the United States are met with in institutions for the insane. Poverty seems to be a predisposing cause, and many cases have been met with among the United States peasants.

Within the last twelve months three cases of pellagra were admitted here suffering from the disease on admission.

One, an East Indian woman, hailed from the parish of Westmoreland; another from Croft's Hill in the parish of Clarendon, whilst the third was transferred from Kingston General Hospital, or centres widely apart; thus it may be inferred the disease is not confined to a certain part of the Island, but has a wide distribution.

The history of C. I., aged 29, from the highland of Clarendon is a fairly typical one, though it does not contribute to the solution of the etiological problem.

He was admitted on the 29th day of March, 1911, suffering from an attack of mania, but within a week he showed signs of recovery and was given employment on the cricket ground.

He inherited insanity and this was his second attack.

On admission there were no signs of pellagra, but on the 12th of April he complained of pain and "redness" on hands and feet; on examination he presented a well-marked pellagra erythema on the backs of his hands, the extensor surface of the feet, which appeared during the week; his attention was drawn to it by the itching, which was quickly followed in a day or two by redness and burning pain.

His feet are slightly oedematous, and on the left there is a small bleb.

He states that in April last year he had a similar attack in the same situation and that his skin afterwards turned black (he is a light brown colour). It lasted about three months. He never suffered before, nor had he seen a similar condition in the district whence he comes.

Maize is grown and used in the locality in the form of hominy pap, dumplings roasted and boiled. He took a small amount himself prior to his first attack, but not much.

He is well acquainted with sand flies which exist in the district; there is a mountain stream and stagnant water about a quarter of a mile from his house; there is also a spring forming a small stream three chains from the house.

The disease almost invariably appears in the spring, continues through the hot summer in most cases, and disappears during the winter months, only to make its re-appearance the following spring, and gradually sap the life of the unfortunate patient.

Atoxyl and other arsenical preparations recommended for the treatment of the disease have proved disappointing in our hands, whilst some cases under treatment presented unmistakable signs of arsenical poisoning.

Rest in bed, with tonics, cardiac stimulants, and generous diet give better results.

To-day, with a population of 1,172, we have 29 females and 10 males suffering from pellagra.

I have, &c.,

D. J. Williams,

Medical Superintendent.

No. 12.

WINDWARD ISLANDS (ST. LUCIA).

REPORT OF LABORATORY WORK, INCLUDING SANITATION AND RESEARCH, FOR THE SIX MONTHS ENDING SEPTEMBER 30th, 1910, BY DR. L. NICHOLLS.

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1. Fig. I. Ulcer fly (fly I.).
2. Fig. Ia. Drawing of organisms in large excavated ulcer of the leg.
3. Fig. Ib. Fæces of ulcer fly showing effect of digestion upon organisms shown in Fig. Ia.
4. Fig. II. (Vegetable) Fly (fly II.).
5. Fig. III. Fly III.
6. Fig. IV. Dissections of Fly II.
7. Fig. V. Drawing of a blood-sucking Tipula.

In the following report I have included some work and observations that are not strictly connected with the laboratory. My aim has been to bring all work that can be of value in local sanitary, medical, or other matters into the range of the laboratory. Small Governments cannot afford to equip laboratories for a few technical subjects and research work only. It is therefore desirable that all possible affairs which can be dealt with by one with a scientific training should fall to the division of labour which includes laboratory work.

L. N.

The Ulcer Fly and its Relation to Yaws and other Ulcerated Conditions.

I have studied several of the smaller flies in this island, as they undoubtedly act to a greater or less extent as the conveyers of the organisms of disease. The most important of these is a small *Acalyptrate muscid*, which might be called the ulcer fly, as it is found in association with ulcers, skin lesions, and abrasions of man and animal. They can always be seen in country districts, hovering around the bare legs and arms of the labourers, searching for abrasions, and possibly also the secretion of the sebaceous glands. In cases of yaws, leprosy, syphilis, and other like conditions in which there is considerable discharge from extensive areas, the atmosphere around is thick with them, especially at certain times of the year.

The fly is about one and a half millimetres (1-16 inch approx.) in length, and less than one in breadth (Fig. 1d). Its colour is a mixture of black and yellow, the

dorsum of the body and the whole of the thorax being a shining black, the legs, antennæ, mouth parts, halteres, and the under distensible portion of the abdomen are yellow. There is a metallic shine on the wings. The antennæ appear to consist of three not easily definable segments, with non-terminal aristæ. The wings when closed completely overlap one another, and reach well beyond the tip of the abdomen; their venation is simple, being composed of five veins running longitudinally, with two transverse veins, situated between the third and fourth and fourth and fifth respectively; fine hairs extend around the entire margin of the wing. (Fig. 1B.) The claws of tarsi are simple and equal; the fly is not very hairy.

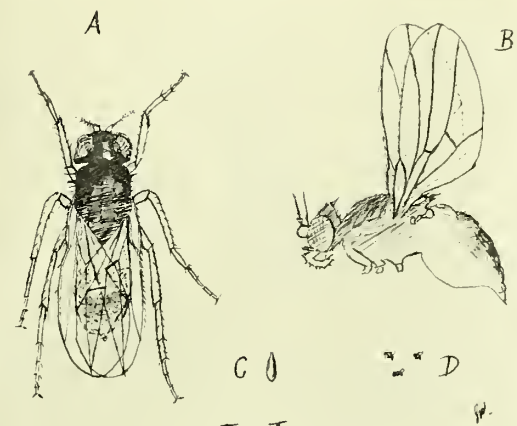


Fig I

The persistence of this little fly is extraordinary. As soon as an abrasion occurs or an ulcer is exposed, numbers of them immediately swarm over it, and they must be brushed off by actually touching them, when some will immediately return, others will search any animal or man in the neighbourhood for other lesions or abrasions of the skin; they will even try to insinuate themselves under dressings. They engorge themselves with pus, blood, serum, and sebaceous secretion until their abdomens are greatly distended.

The distance that they will fly in search of food is probably not great, but they will follow man or animal that affords them an abundance of food for a long way.

I have had several opportunities of comparing their flight with that of the common house fly (*Musca domestica*) :—

A patient in a very ulcerated condition, who was going to the Yaws Asylum, accompanied me in an open mule truck for three miles. At the start I noted a very large number of these small flies on the eruptions and ulcers, and hovering around the patient there were also a few *Muscæ domesticæ*. The track lay through cane plantations, and before we had covered half a mile all the latter flies had been seen to return, but the little ulcer flies were as numerous as ever, and remained so for the three miles; a few occasionally left the patient to hover round and search the other occupants of the truck for abrasions. Careful watching and a consideration of the surrounding country was extremely suggestive that they were the same flies that started.

On another occasion I carried a yaws patient eight miles by sea in an open boat, being from one hundred yards to half a mile from land according to the coast line. There were many of these flies around him from the time we embarked to the time we landed; I watched them passing to and from the other occupants of the boat. In this case a few house flies had been present, but returned before we had gone one hundred yards from the shore.

It may be noted in passing that in a large number of observations on *Muscæ domesticæ*, it is seldom that they will follow man or horse more than half a mile, and careful watching shows that they return to their original habitat or breeding-ground. The Yaws Asylum is an excellent place to study the ulcer flies; every exposed and moist ulcer and abrasion has innumerable flies upon and hovering around it.

The eruptions of yaws tend to become very hard and dry. The flies can be seen searching all around them, and if the scab is by chance or purposely removed, or even slightly raised so that a little serum, blood, or a moist surface is exposed, they

will immediately feed upon it, almost forcing their probosces under the scab. The dry, hard surface they cannot feed upon.

They continually pass from patient to patient, and any visitor to the Yaws Asylum is carefully searched for skin abrasions by these little pests.

It is the same with animals :—dogs, horses, mules, cows, and pigs; these flies are commonly in association with them, feeding on the pathological discharges of the skin, and also, it appears, on the normal glandular secretions.

I have examined bacteriologically a large number of ulcers, together with the little fly found in association with them. I will first describe the common ulcers of the island :—

People who work with their legs bare are extremely liable to ulcers, and these, for the convenience of description, can be placed into two categories :

(1) Those due to lowered resistance of the tissues;
(2) Those due to organisms of normal or exalted virulence.

It is fully understood that these conditions are usually both more or less present, and that there are numerous gradations in them.

In examining the bare legs of an aged labourer, in every case one will find evidence of past injuries and disease. The skin is in one place heaped up and thickened, in another as thin as parchment, with numerous linear or broad puckered scars on the front surface of the shin; or there may be a glazed, shiny, unhealthy appearance of the whole leg below the knee. These legs, very liable to ulcers, show very poor recuperative powers. The condition has been brought about by a life-long exposure to injuries and infection; working on the land and in the bush, the legs are continually afflicted with small bruises and cuts; they are submitted, now to the shade with a temperature of about 80° Fah., and now to the full solar radiations of 140° Fah.; besides there is the influence of rain and the consequent atmospheric drying; again, syphilis and yaws are prevalent, and on the top of this exposure to the weather there may be present an arteritis or perhaps very numerous scars from past eruptions.

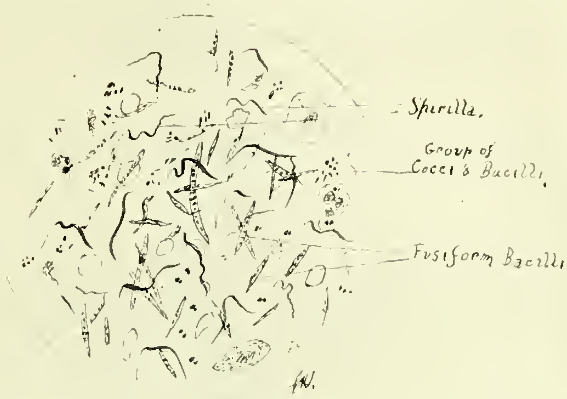
The many acquired abrasions are continually visited by the ulcer fly, and even if it brings organisms of low pathological powers and saprophytes, they will probably find a suitable soil on which eventually to produce an ulcer. I have injected small doses from cultures of the numerous bacilli and cocci of these ulcers into guinea-pigs, but they have never produced the violent action of a virulent organism. It therefore appears that organisms of high virulence are unable to flourish in these ulcers, for in the more superficial parts they are destroyed by saprophytes and their products, and in the deeper parts the tissue and blood are more resistant and possess a high degree of immunity.

Therefore the principal causative factor of these ulcers of middle-aged and old people is the life-long exposure of the unprotected skin. The neglect to keep them covered and the continual visit of the little fly must also play an important part.

Under the second heading falls yaws, leprotic, syphilitic lesions, and the primary ulcers of children and young adults. There is one type of the latter that is very frequently seen in the rainy seasons. It is a large excavated ulcer, generally situated on the leg—there may be several, but as a rule it is single; sometimes it occurs in connection with the nails of the hand or foot, or it may become so deeply excavated as to reach the bone, when it causes a curious heaping up of bone, which looks like a cross between a periostitis and an osteophyte.

The bacteriology of these ulcers in connection with the ulcer fly is of importance. Smears from this ulcer always show very numerous large fusiform bacilli ($10\text{-}14\mu \times 2\mu$), and usually almost as many spirilla.

The protoplasm of the bacilli shows considerable differentiation in staining, this being due to numerous dots and bars which take up the stain in varying degree. They may be said to be Gram negative, though some specimens retain the stain with considerable persistence; it appears that some of the protoplasmic contents are not easily penetrated by the reagents. Fig. 1a is a somewhat diagrammatic representation of these organisms.



DRAWN FROM A SMEAR FROM A LARGE CIRCULAR EXCAVATED ULCER OF THE LEG.

Fig Ia

DRAWN FROM MICROSCOPICAL PREPARATION OF FAECES OF ULCER FLY.

Fig Ib

Cultures from these ulcers will grow, among other organisms, staphylococci. One of the principal values of a study of the bacteria of these ulcers is that they demonstrate some of the actions of the digestive ferments of the fly's alimentary canal upon micro-organisms.

There can be considered two ways by which organisms are conveyed by flies : the germs are taken up with the food of the fly and some time afterwards passed out with the fæces in a new situation (flies often defaecate while feeding); or the germs have adhered to the body or legs of the fly and are thus carried. Flies, however, clean themselves of most foreign matter that they have picked up while feeding.

One of the before-mentioned ulcers is exposed, and it immediately attracts a large number of flies; these are collected by inserting a sterile conical wide-mouthed flask over the ulcer and the flies entering, the vessel is plugged with sterile cotton wool.

These are carried to the laboratory and a few microscopical slides are placed on the bottom of the flask. Soon there is seen on the inside of the flask and on the slides a number of small fæcal specks. Those on the slides are examined microscopically. Some of the flies are killed, teased with needles so as to expose the stomach and upper parts of the alimentary canal and also the lower parts; smears are taken of these.

In this way a series of slides is prepared, the first coming from the ulcer, others from the alimentary tract, and the last from the fæcal matter of the fly. The

action of the digestive ferment can now be seen, the organisms as they pass through the fly becoming much less numerous and do not stain so readily. Fig. 1b, a drawing from the preparation of fly fæces, shows that one or two bacilli fusiformis have to all appearances succeeded in escaping the action of the digestive ferments.

Flies caught on leprotic ulcers sometimes show a different picture; their fæces exhibiting numbers of acid-fast bacilli, morphologically indistinguishable from those found in the skin lesions.

The *bacillus fusiformis* is in another disease found in symbiosis with a spirillum—the condition known is Vincent's Angina, perhaps better called by the Germans "Spirochætenbacillen Angina." I once examined the throats of five school boys and found this easily demonstrable condition present. It apparently had been acquired in this way; one of the boys possessed a curious, and to his companions a highly desirable, whistle, which, if properly blown, would reproduce rough imitations of the pipings of various birds; the result was that the instrument was passed from mouth to mouth, and the *bacillus fusiformis* and *spirillum*, a few of which are normally present, gained virulence in being passed backwards and forwards in strained throats.

It may be that these organisms, in the same way, gain virulence in being carried from ulcer to ulcer by the little fly.

On one occasion a case of yaws showed unusually numerous spirochætæ. I therefore removed the scabs from the eruptions and allowed the little flies to feed, and then attempted to trace the spirochætæ through their alimentary canals. Only in two of the numerous preparations examined was I able to demonstrate them—and these were taken from the upper part of the alimentary tract a quarter of an hour after the flies had fed, and even the blood cells were scarcely altered.

I do not believe that such delicate organisms as spirochætæ can long survive the action of the digestive ferments of insects, unless, as in the case of malaria, they have some definite relations with the insect—and this is highly improbable.

I have done many experiments on the passage of pathogenic organisms through the digestive tract of the next fly to be described, because, as it will live and breed in confinement, it is much easier for this work.

One experiment was made with the ulcer fly to test the second mode of conveyance, namely, by the germs adhering to the external structures of the insect.

A number of flies were caught and placed in a large, sterile flask. After being in this for an hour they were removed to another flask. Normal saline was now shaken up in the first flask and cultures from it made on Petri plates, no *staphylococci* v. *aureus* grew. The mouth of the second flask containing the flies was inserted over a boil which was discharging pus with numerous *staphylococci* v. *aureus*. They quickly fed upon this material. They were allowed to remain in this vessel for an hour, and could be seen carefully cleaning themselves. A series of sterile litre flasks had been prepared, and each hour they were allowed to pass into a fresh one. The experiment was stopped at the end of twelve hours, for one or two of the flies had died. Normal saline was placed in each flask and shaken up, and cultures taken. The results were not very uniform, as cultures from the sixth, ninth, and eleventh-hour flasks did not grow *staphlyococcus aureus*, but all the others, including the twelfth-hour, did.

There are certain obvious fallacies in this experiment, such as the flies infecting the inner surface of the flask and then in their wanderings re-infecting them. Nonetheless, it shows fairly conclusively that they can infect a surface on which they alight with organisms which they have picked up many hours before.

These following factors in connection with yaws or framboesia, which is still very prevalent in the West Indies, indicated probably relationship to these ulcer flies:—

(1) Yaws occurs among the labouring classes only, and nine out of ten of the cases occur in the country districts.

The ulcer fly is far more prevalent in the country districts and villages than in the towns.

(2) The agricultural labourer has bare feet, legs, and arms, and often other parts of his body are exposed, and these exposed parts are extremely liable to small abrasions caused during his work in the " bush," cane-fields, or cocoa estates.

The ulcer fly is continually hovering around labourers in search of injuries.

(3) The labourer of the country is in greater association with mules, cows, horses, &c., than the labourer of the town.

The ulcer fly occurs in association with these animals.

(4) The curve of incidence of yaws and the amount of rainfall indicate some association.

The ulcer fly is far more prevalent in the wet than in the dry weather.

(5) Yaws is associated with dirt and squalor.

Flies are associated with dirt and squalor.

I include in this report a chart of the amount of rainfall per month for the past eighteen years, and another of the number of cases admitted to the Yaws Asylum since 1883. A further chart is included comparing the curves, which are arrived at by reducing to percentages.

I*a*.

CASES ADMITTED TO YAWS ASYLUM.

—	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1961.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910	Total.
January ..	11	1	12	21	1	19	15	1	—	1	3	2	1	12	2	11	1	6	3	—	3	5	1	2	4	5	8	—	151
February	14	17	4	8	2	8	23	12	1	—	—	4	2	1	11	2	4	6	1	—	—	3	1	2	7	3	6	—	142
March ..	15	5	27	7	3	13	17	4	1	4	2	6	1	2	5	1	5	3	1	2	4	14	2	3	5	8	7	—	168
April ..	4	8	8	11	6	14	8	1	7	2	1	4	2	1	—	1	2	7	2	12	5	7	4	2	3	5	1	—	128
May ..	5	11	11	22	12	11	7	—	2	3	5	3	4	10	2	4	—	8	1	2	2	1	8	3	6	3	3	--	149
June ..	3	3	22	19	9	23	4	7	4	11	2	4	—	—	3	12	2	3	—	2	2	3	5	3	3	6	3	—	160
July ..	8	4	14	9	14	16	2	7	7	4	3	6	1	3	—	11	5	8	6	13	6	4	6	4	4	7	1	—	163
August ..	21	11	14	3	18	14	2	5	9	8	5	6	5	13	7	4	4	11	6	8	2	4	9	5	8	16	4	—	215
September	21	19	11	13	15	31	1	8	3	5	6	1	5	5	7	9	6	9	—	6	4	5	9	4	10	13	6	—	232
October ..	15	10	12	12	33	34	1	5	8	6	7	5	6	4	6	12	1	4	4	12	5	4	8	8	7	15	7	—	261
November	9	8	13	24	14	48	3	7	3	5	2	9	7	4	12	5	10	8	4	8	4	5	5	11	19	4	5	—	256
December	5	6	11	15	7	8	2	7	1	6	5	1	2	9	7	5	3	2	3	4	2	5	4	5	11	13	12	—	161
	131	103	159	164	134	239	85	64	46	55	41	51	36	64	62	77	43	75	31	69	39	60	62	53	87	98	63	—	2.186

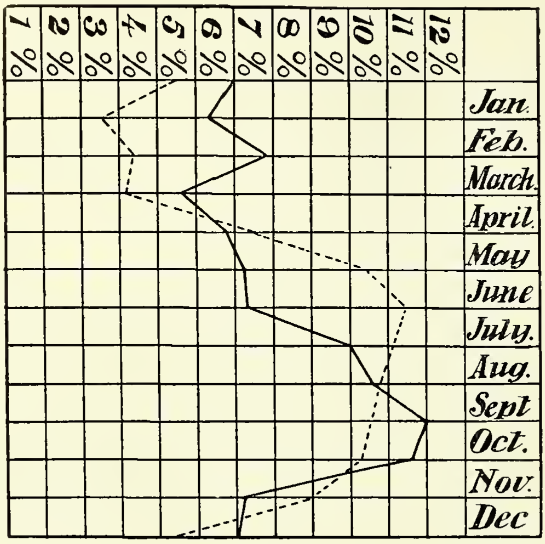
I*b*.

RAINFALL CHART.

—	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Averages for 19 years.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
January ..	10·6	3·9	7·3	4·5	6·0	11·1	5·5	3·8	4·6	6·4	2·4	4·6	2·5	4·0	8·5	2·9	3·3	3·6	2·2	5·18
February	4·8	5·0	2·6	6·4	4·1	2·0	2·9	4·4	3·0	3·5	2·9	1·0	1·4	4·2	4·8	1·7	1·9	2·4	2·5	3·28
March ..	3·8	1·2	5·0	3·1	5·8	6·4	6·8	5·8	4·4	5·1	3·1	2·1	2·4	3·3	3·5	5·3	2·4	2·9	2·5	3·98
April ..	4·2	1·9	4·0	9·6	2·8	4·3	13·0	1·8	5·2	1·3	2·8	1·0	1·9	3·3	2·0	3·0	2·0	2·2	5·7	3·82
May ..	4·0	4·3	14·8	9·0	2·7	14·5	12·0	18·9	2·4	1·3	7·3	4·7	9·2	2·3	6·3	5·2	5·1	4·2	3·8	6·98
June ..	6·5	6·2	20·1	10·6	7·7	4·6	14·3	8·9	6·7	8·7	6·2	9·2	2·3	6·3	5·2	5·1	4·2	8·7	5·8	9·39
July ..	5·6	9·1	11·1	18·5	5·7	7·7	10·9	12·7	13·0	7·3	8·0	16·4	9·3	13·2	8·3	9·0	9·8	8·5	10·5	10·28
August ..	10·1	9·7	6·1	12·8	5·4	10·4	7·9	13·6	13·2	17·3	13·2	9·5	12·3	10·8	9·1	10·0	13·5	6·0	5·5	10·38
September	5·2	4·2	13·1	11·9	7·1	17·2	7·1	6·9	25·2	8·6	7·1	21·2	9·6	6·1	8·3	8·3	9·3	8·6	8·9	10·24
October ..	12·0	9·4	10·6	8·4	21·0	13·2	4·8	12·2	10·9	7·0	9·8	3·9	7·8	12·3	9·8	8·0	11·5	8·2	9·7	10·08
November	7·3	11·0	8·3	11·4	7·8	17·3	17·4	11·4	12·2	11·8	6·8	7·9	12·7	6·2	6·1	9·7	8·5	7·8	4·8	9·84
December	12·5	3·7	6·1	6·8	4·8	12·1	10·9	10·3	6·1	5·9	3·1	11·5	9·3	16·4	3·9	3·9	5·1	7·7	17·5	8·34
Total rainfall each year.	88·11	70·15	109·67	113·60	81·55	121·29	113·93	111·26	107·49	84·64	73·25	99·71	91·43	86.84	77·72	72·64	81·84	71·33	79·98	91·39

In the following chart the dotted line represents the rainfall reduced to percentages of the total for each month. The unbroken line is percentage of admissions to Yaws Asylum per month.

II



If chart No. I*a*. is examined, it will be seen that after the year 1889 there was a considerable reduction in the number of cases of yaws, and that in recent years these have tended to rise again. This is probably due to the fact that the isolation regulations are not as stringently carried out as they were.

Chronic cases that are continually remitting are a great source of danger. It is surprising how often I have been able to trace small outbreaks to a chronic case in the immediate neighbourhood: the patient has often already been to the asylum and discharged as apparently cured. I would recommend that in all cases of yaws a careful examination be made of the locality for the purpose of sending every case to the asylum. If a better outlook were kept for stray cases, and the isolation regulations thoroughly enforced, this objectionable disease would soon reach a disappearing point.

I would consider it undesirable to allow cattle and other animals in too close association with the Yaws Asylum.

In summing-up the ulcer fly, I would say, that in all diseases in which the organism occurs in surface lesions, the fly may play the principal part in the dissemination of the disease, but, from the nature of the case, the germ may be conveyed by other mechanical means.

The Vegetable Fly.*

I have succeeded in working out more of the anatomy, development, and its relations to a greater number of micro-organisms of the fly about to be described than of the last fly. The reason being: it is a little larger, the integuments are softer—allowing it to be more easily dissected, and it feeds and breeds when confined in cages. It is—from its association with vegetable food and that it often swarms over fæces for undigested portions of vegetable matter—of importance from a sanitary point of view.

The general characters of this fly are very like those of the last, it is of the same genus, but its general appearance and mode of life are very different. The length is about two millimetres (1-12 inch approx.); the eyes are bright red to reflected light, and the body is of a dull brownish-yellow colour. The male is distinguished from the female by the abdominal segments being black banded dorsally, and the male aristæ are somewhat plumose. Fig. II. is a drawing of a male fly, and shows the venation of the wings, which is almost indistinguishable from that of the ulcer fly, there being five veins running longitudinally and two transversely between the third and fourth and fourth and fifth. The fly is fairly hairy. Fig. IIb. shows the actual size.

* Further observations and experiments have shown this fly to be of importance in the fermentation of cocoa. If unnamed it might be called "Sapromysidæ ? Theobromæ."

Fig. IV. represents some of the anatomical characters of the male and female.

The development of this fly is rapid, the egg hatching and the larva passing into the pupal stage under favourable circumstances well within three days; the pupal condition is very variable and may last from three or four days to several weeks. One week would represent the average length of time from the egg to the fly.

The egg has an outer covering of reticular appearance, and connected with this are two prolongations with slight terminal expansions. These are the last parts to emerge, and flies will often be seen in which the entire egg has come out, but is still connected with the fly by these prolongations, and it requires some slight pulling to get it away. When the egg is placed in water it floats, these tube-like parts being on the surface and the rest of the egg hanging down under water.

The covering, including these organs, can easily be teased off the rest of the egg. (Fig. II.D.)

The first stage in the development is thickening and toughening of the covering with loss of its prolongations. Next, a small active larva emerges—it is amphipneustic, the anterior pair of stigmata being curiously fimbriated. (*Vide* Fig. II. C, E, and F.) This little maggot grows rapidly, and in one or two days it can be seen quiescent and undergoing shortening and thickening as its integuments harden into the pupal case, which also possesses anterior fimbriated stigmata. (Fig. II.G.). The fly emerges by splitting the puparium somewhat in the same manner as is shown in Fig. III.D.

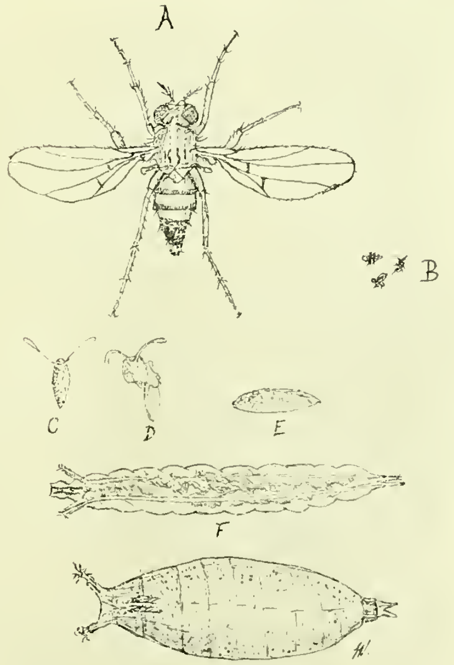


Fig II

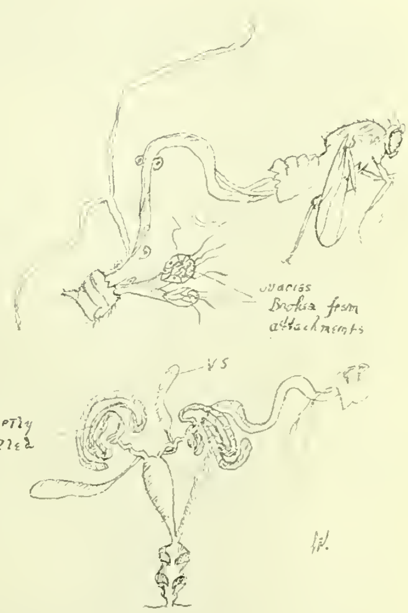


Fig IV

A layer of wet, decomposing farine is placed in a cage with a number of these flies; in a few days the surface will be seen dotted with pupæ, the stigmata protruding well above the surface. If this is dried so that the farine becomes hard, the flies will not emerge, and they can be kept for weeks in this condition. On the addition of a little moisture so that the mass becomes softened, the next day the flies will start to emerge.

This may have some connection with their greater prevalence in wet weather.

They can usually be seen in swarms around farinaceous foods and fruits; under any tree where the fruit has been allowed to fall and decompose upon the ground there will be a number of them. In the country parts they are very numerous around cocoa sweating boxes, and many of them can be seen in the houses swarming over melons, pineapples, or any any moist vegetable food. They are also seen on fæces. I kept a large number in a cage—feeding and breeding them on decomposing farine and breadfruits; if a vessel containing fæces were placed in the cage they

would immediately leave the other food and swarm over it, nor would they leave it until they had obtained all undigested vegetable matter.

In studying their relations to micro-organisms, the method adopted was to infect sterilized foodstuff with fresh cultures. The flies were fed upon this and allowed to enter a sterile flask; every half-hour they were admitted to fresh sterile flasks; at hour intervals a few were chloroformed; these were seized with fine forceps and the head parts and legs just allowed to touch the surface of sterile glycerine and water. They were now thrown into a tube of broth and smashed up with a glass rod.

Cultures were now taken of the glycerine and water and of the broth. From the first they were very variable, but from the second they were more constant.

The following shows the results of 16 experiments conducted with various organisms:—

Organism.	Number of experiments made.	Hours after infection in which organism was cultured from glycerine and water by contact.	Hours after infection in which organism was obtained from the smashed-up fly.
Staphylococcus aureus	5	1 experiment, three hours ... 1 ,, six hours. 2 experiments, ten hours. 1 experiment, twelve hours.	In all experiments, twelve hours after; in four, twenty-four hours after.
Staphylococcus albus	2	1 ,, five hours ... 1 ,, eight hours.	In both, twelve hours after.
B. Coli communis	4	1 ,, six hours ... 3 experiments, twelve hours.	All four, twenty-four hours after.
B. Danysz's	1	1 experiment, seven hours ...	Twelve hours.
Streptococcus brevis (from mouth)	2	1 ,, three hours ... 1 ,, ten hours.	One, five hours; one, twelve hours.
Bacillus prodigiosus	2	1 ,, two hours ... 1 ,, eight hours.	Both in twelve hours.

It can be seen from this that the results are very variable; in all experiments, of course, numerous saprophytes grew. We must conclude, therefore, that the fly tends to get rid of certain organisms by means of cleaning itself and its digestive ferments, besides the action of the numerous saprophytes always associated with it: none the less it usually retains these organisms in some portion or other of its body for at least twelve hours, but it is much less common for them to remain in contact with its integuments for this length of time. Again, some organisms have much greater resistance than others, and are less likely to be destroyed by the fly; such a resistant spore-forming organism as *B. anthracis* would obviously survive in relation to a fly better than so delicate a germ as a spirochæte.

The next fly belongs to the series *Cyclorrhapha Aschiza* and to the family *Phoridæ.* Its life history is chiefly connected with animal foodstuff. It breeds readily on soured and decomposing milk or on any form of meat or meat extracts.

I have seen it on fæces, numerous decomposing animal matters, including the human corpse, meat, fish, cheese, and even fruit destined for food.

It is, however, not a common fly in many localities.

It differs most markedly from the last flies described in its powers of running and flying. A glance at Fig. III. will show depicted its powerful, long legs and short, small wings, which do not even reach to the end of the abdomen. The result is that instead of hovering around any object for food or a place to deposit its eggs, it alights on or near it and runs all over it. Obviously, from this propensity each individual is far more likely to become infected and to infect that matter over which it passes than the last fly described.

The fly ranges in size from 2½-4 millimetres. It is of sombre appearance, being a mixture of dusky-yellow and black. Its antennæ are two-jointed and bear curved setæ. The coxæ and femora are very broad and thick. The wings have two dark, broad, and short veins running longitudinally and meeting the costa; the second, which meets this margin of the wing at about its middle, bifurcates very near its end. Coming off from this vein are three lighter veins, which run, more or less parallel to each other to the opposite margin of the wing; there is a fourth vein that is homologous with these, but commences somewhat indefinitely. There are no

transverse veins. The hairs do not run further along the margin of the wing than the point where the second dark vein bifurcates into the costa. (Fig. III. B.)

Development.—The egg has a peculiar papilliform covering; apparently the reason of this is to increase the buoyancy of the egg, as the spaces between the papillæ hold minute air globules, much in the same way as the numerous hairy projections on the leaves of many water plants.

The eggs hatch into amphipneustic larvæ of eleven segments. In three days to a week these are seen crawling out of the matter in which they were hatched to some dry surface where their integuments harden into a pupal case; their anterior tube-like stigmata become formed into breathing tubes on the fourth segment of the pupa. After a time—variable, according to temperature and obscure circumstances—the fly emerges by splitting the puparium in the manner shown in Fig. III. D.

If the pupal case is kept very moist the fly is unable to open it. Drying renders it brittle and friable, so that internal pressure will split it.

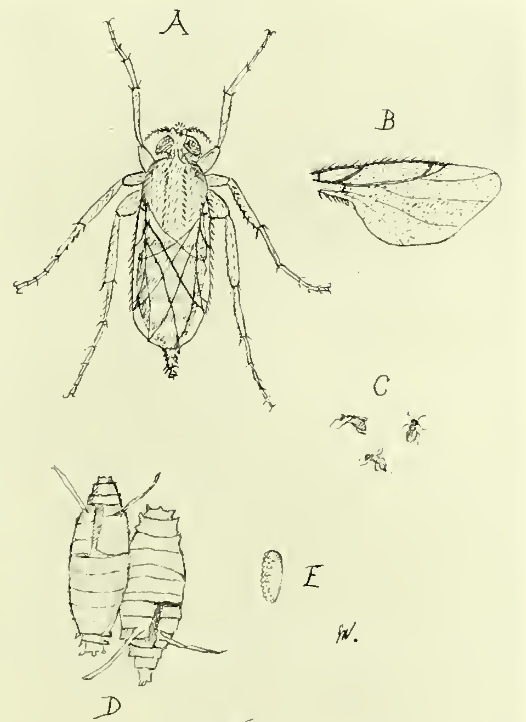


Fig III

The means of exterminating or lessening these pests consists in promoting general sanitation, such as cleanliness in the surroundings of man and domestic animals, and the destruction of all refuse. Besides this, isolation and protection from flies of the diseased and their excreta.

In the case of ulcers and other skin conditions, a liberal amount of dressings, disinfectants, and ointments should be supplied to prevent the access of flies. It is extraordinary in this island how common it is to see people going about with exposed ulcers and sores, or if they are covered the dressings are old and dirty, and soaked with the discharge, and are an attraction to innumerable flies. I would recommend that (as is now done successfully with quinine) materials be given to planters, presbyteries, and police stations, who would supply, free of cost, all labourers suffering from ulcers. The cost of these dressings, disinfectants, and ointments would, if properly controlled, only amount to a few pounds in the year.

Malarial Preventive Measures.

Under this heading is included the work that has been done to the end of September, in finding anopheline breeding places, the distribution and establishment

of " Millions " fish as natural enemies of the mosquito larvæ, the cleaning of rivers and ravines, the distribution of quinine, and a spleen census; the last is to attempt to decide the value of the work falling under this heading; it must therefore be repeated at about the same time each year.

All the work under these subjects is paid for out of a vote of £100; it is, however, to be hoped, as the lines along which beneficial results may be obtained are shown by careful experiments, that this sum will progressively increase.

In a report last year I discussed observations and experiments on the natural enemies of mosquito larvæ, and showed how, if properly exploited, it was indicated that they would be followed by a considerable measure of success. Since then I have distributed them to a large number of places, and the results have more than equalled my expectations.

Last May a native was employed as moustiquier and quinine distributor at the pay of £30 per annum; he was shown the distinguishing features of the anopheline and other mosquito larvæ, then he went round the country to search for them; notes were kept of the places in which they were found and they were sent to the laboratory; I also afterwards visited all the principal places. He then went round to stock each place with fish which were carried in an ordinary live-bait can.

After rains he is on the look-out for fresh breeding grounds. All the more accessible places are revisited at intervals of a fortnight.

Pools, gutters, ravines, numerous swamps, and streams have been stocked and re-stocked. More than ninety per cent. of those situations which have not dried up can now be seen more or less swarming with little fish. One notable example deserves special mention :—Six pregnant female fish were placed in a network of streams and drains around the Chaussee Road, Castries, on May 10th, 1910; by the end of June the whole of these drains were veritably alive with the fish, in fact, after a few dry days, when the water had shrunk to a smaller area, the fish can be baled out with the hands in large numbers. Since June it has been an inexhaustible supply for distribution to other surroundings. Nearly every day one or more kettles of fish have been obtained from these drains. To mention a few places where the fish appear to have become permanently established :—the drains and numerous ravines and pools in Castries, the Hospital Road, Vigie Swamps, the roads to Choc and Ciceron, the valleys of Cul-de-Sac and Roseau, one place in Anse-la-Raye, several parts of Soufrière, besides new surroundings in Gros Islet, Dennery, and Vieux Fort.

An attempt is made to stock all pools after and during rains in which there is a probability that they will last a fortnight. Two or three dry days will cause the disappearance of a vast number of pools, but if there is rain, the pools continue to last.

There is an important breeding ground of anophelines (*Cellia argyrotarsis*) which is unsuitable for " Millions." It is low-lying, marshy ground, full of surface irregularities and rank vegetation; in the dry weather there are no pools, but with rains the ground becomes water-logged, and very numerous water-holes of varying size are formed; the larger of these are favourite breeding grounds for numerous dragon-flies and coleoptera; consequently only an occasional mosquito larva is found in these, but in the smaller holes, with a depth of water ranging from half to two inches, larvæ, especially of *Cellia argyrotarsis*, are extremely numerous. These are inaccessible from the larger pools, in which fish, unless placed at their first formation, are destroyed by large coleopters and neuropters.

It is, of course, impossible to place " Millions " in all the myriads of small pools, and in many of them they cannot compete against the mosquito larvæ, for the pools continually dry up to liquid mud, in which the fish will not live, but the larvæ are able to lie on the hot, wet surface for at least forty-eight hours, waiting, as it were, for fresh rainfall, and in the rainy season few days pass without rain. That they can exist for the period of time stated on the surface of liquid mud I have repeatedly proved by actual experiment.

Fortunately these unhealthy marsh lands can easily, and at a fairly cheap cost, be drained, either by cutting open drains, which can be stocked with fish and kept clean, or by sub-soil drainage,—the latter is not always possible. In two places where I was at first unable to establish " Millions " on account of the presence of " mud fish," dragon-fly larvæ, and crustaceans, I killed out these denizens by poison, and

then when fresh rains had washed away the poison, I was able to introduce the fish, which have since flourished there; the poison used was " cyllin "; but obviously methods of this sort have great limitations, as the presence of cattle or the possibility of contaminating drinking water completely prohibit it; yet " cyllin," which gives the water a strong scent and a milky appearance, is not likely to be drunk by man or animal.

The fish do not flourish well where they are subjected to rapid changes of temperature; thus in very shallow water where there is no shade and they are exposed to the direct rays of the sun, they usually die; the quick cooling at night and the rapid heating in the day is apparently the cause. In the same way iron tanks are not as suitable for them as concrete or wooden vessels. I have, however, had fish in an iron tank for well over a year, and although they have never died out they have not multiplied sufficiently to cause any noticeable increase.

I am now placing barrels of fish at the police stations in the island, so that after rains they can be easily distributed to a variety of places.

I was asked by the " Ministère des Colonies " of Belgium as to the possibilities of the " Million " fish on the Congo; I could not dogmatize on the matter, as the physical conditions and the fauna and flora of the country are unknown to me. I urged that if the subject were pursued in no haphazard or slipshod manner, and a man with some knowledge of zoology, who could reason on the successes and non-successes, were employed, and the fish, transported in wooden vessels, were first bred in protected places, there appeared no reason why they should not become a considerable asset in mosquito reduction.

Each female fish brings forth about twenty-five fully developed young fish at intervals of a month to six weeks, and under very favourable circumstances in less time. The young become breeding adults in three to four weeks. From this it can be seen the enormous rate at which, under favourable circumstances, these fish can multiply.

The more I work with these little fish, so beautifully adapted as destroyers of mosquito larvæ, the more I become convinced that, exploited with intelligence and thoroughness, they are a great asset in anti-malarial work.

It must be remembered that they have limitations, and should always be combined with drainage in certain localities and cleaning of the edges of rivers and ravines.

If a comparison is made between their action and that of oiling the surface of water in tanks and marshes with " kerosene," it can confidently be asserted that in most cases they are equally efficacious and will last longer, besides which, they have the overwhelming advantage of costing nothing once they are established.

Cleaning Rivers and Ravines.

In cleaning the edges of rivers and ravines, I have come to the conclusion that this requires more attention in the dry than in the wet weather. For, when there is much rain a large and continual volume of water is passing along the rivers and ravines, so that even the cul-de-sacs are washed clean, and reeds, grasses, and other plants along the edges cannot flourish, as the water is continually rising above them. Thus with a strong current and no protection mosquitos cannot breed, but as soon as there are a few dry days, the vegetation near the water grows rapidly, and the water in the rivers and ravines becomes slow or may even cease, so that anophelines are now able to flourish. In dry weather, when I have been unable to find the larvæ elsewhere, I have always been successful in these situations, where they cannot be found in wet weather. Therefore I consider that these places which do not breed vast numbers of anophelines, as do the marsh lands, require most attention in the dryer weather.

In all these matters no rule-of-thumb law can be laid down that will be applicable everywhere, the circumstances that surround the matter in one locality being obviously different from those in another.

Spleen Census.

A spleen census was taken of the schools of Castries and Anse-la-Raye; the latter is probably the most " fever "-stricken village in the island.

I asked each child who was sufficiently old to thoroughly understand if he or she had had "fever" and ague; if so, when had he or she had it. Further questions were put to decide that the disease had been malaria, such as: "Was the 'fever' always on you when you were ill?" "Do you know what medicine was given you?" To the last question it was surprising how often the children answered "quinine."

I include under heading "Spleens very large" only those that reached to the region of the umbilicus.

Spleen Census for Castries.

Number of children examined	1,002
Number asked if they had had malaria	687
Number answering in the affirmative	243
Number answering "This year"	563
Spleens felt	278
Spleens very large	14
Percentage of spleens felt	27.79
Percentage who answered "This year"	35.3
Percentage who answered in the affirmative	81.9

Spleen Census for Anse-la-Raye.

Number of children examined	195
Number asked if they had had malaria	83
Number answering in the affirmative	75
Number answering "This year"	42
Spleens felt	90
Spleens very large	11
Percentage of spleens felt	46.1
Percentage who answered "This year"	50.6
Percentage who answered in the affirmative	90.3

These censuses were taken during July and August; in May, June, and July of this year there had been many cases of malaria occurring. This type of census might give a better idea of the value of various preventive measures than a census which includes palpation of the spleen only, which under the best conditions is open to fallacies and inaccuracies. This may be said of questioning children, but if sufficient care and patience are taken and the answers of the older and more intelligent children only are accepted, it should prove of fair value.

In the middle of the year I commenced the distribution of quinine from the laboratory. Bottles of the crude solution were sent out to all the planters, priests, police stations, and elsewhere throughout the island. Judging by the continual return of bottles to be refilled, it has been a marked success.

It is always well when once a matter has started to continue to urge it. In this case printed forms might be sent round to the distributors, thanking them for their past efforts and urging a continuance of their energies in the matter.

Quinine tabloids have been distributed to the children of the schools of Castries and Anse-la-Raye. I find in many cases the parents send requests for the tabloids when the children have "fever." The number of schools should be extended, for the amount of absence due to "fever" is in some parts very great.

Undoubtedly the belief in quinine, despite the repulsive taste of the drug, and in the mosquito theory, is increasing. It can be confidently expected that the next generation will believe, and act up to, those sanitary theories which the vast majority of their uneducated fathers spurned as absurdities.

Breeding-places of Mosquitos.

Observations at the breeding-places of mosquitoes will show us where they usually breed, whereas experiments will show with an exactness where they can or cannot breed.

I have experimented with genuses cellia, stegomyia, wyeomyia, deinocerites, and culex. Young larvæ were placed in a variety of surroundings, and the results noted. Thus, in the water contained in the wild pine and wild plantain, which is

the natural habitat of certain wyeomyia, attempts were made to breed cellia by placing in these vegetable water receptacles very young larvæ and eggs; but in none of the experiments did they hatch out. It is therefore concluded that it is impossible for them to breed in these situations. The same can be said of the *Stegomyia fasciata*, *Deinocerites cancer*, and *Culex fatigans*, though in the case of these if large larvæ are placed in these plants they will hatch out, whereas the eggs and small larvæ will not. In another series of experiments *Stegomyia*, *Wyeomyia*, and *Deinocerites* were placed in open marsh pools in which anophelines (*Cellia argyrotarsis*) breed; the latter two, which breed in collections of water naturally protected from the sun's rays, very quickly died—apparently from the heat. A curious occurrence happened to the stegomyia larvæ in most of the pools. They became covered with infusorians of the *Vorticellidæ*, which, attaching themselves by their stalks in large numbers, cause the larva to assume an unhealthy appearance, and its movements to become sluggish. The majority of these larvæ die, but a few hatch out after a prolonged time—in some cases two months after they became infected. These infusorians are found on all small active water creatures, such as cyclops, fresh-water shrimps, and coleopters, but in the case of these they are never present in such large numbers as on the above-mentioned larvæ, for they cannot attach themselves to the hard integuments but only at the junction of the segments. A few are sometimes seen on *celliæ*, but I have been unable to infect them with large numbers; the reason appears to be in the fact that these are naturally surface feeders, and rest for hours on the surface of the water, their heads moving round in all directions for food whilst the body is motionless; consequently they defeat the aims of the infusorian, which is to obtain a free and continual passage backwards and forwards in the water, so as to be repeatedly brought into contact with fresh food material. This and the fact that they would attract the attention of their natural enemies are the reasons why no larvæ of the varieties that breed in natural collections of water are nearly as active as *Stegomyia fasciata*, which can be said to be bred almost entirely by man himself, in his barrels, tanks, and other vessels.

There is one important point connected with *Stegomyia fasciata*. Numerous larvæ of these will often be seen in well-screened tanks into which the adult insect cannot get; the reason is that the eggs are laid in water that has settled in the gutter supplying the tanks, and have thus been washed into the tanks, where they hatch, and the majority of them succeed eventually in getting out of the screened tanks, for if there is the slightest enlargement in any of the meshes in the wire screening, the adult mosquito will find it and thus escape. After a few days without food the mosquito becomes very shrunken, and can then get through very fine wire netting, as the following experiment shows :—I placed a number of larvæ in a vessel, and covered the top thoroughly with wire netting meshing 400 to the square inch; over this vessel was inverted a large beaker. A few days after the insects had hatched out they could be found (usually dead) inside the beaker, where they could only get by crawling through the meshes of the netting. The remedy to preventing stegomyia breeding in these tanks consists in having well-laid gutters, with perfect gradations of levels, so that water cannot remain in them, or the gutters may be drilled with small perforations; these cause practically no loss of water to the tanks, and I have seen this arrangement acting well.

Biting Insects.

As it is important that all biting and blood-sucking insects should be recorded I include a drawing of a *Tipula*. From three sources I have received specimens of these; in each case it has been stated that they inflict severe "bites." The mouth parts of tipulas are not commonly formed into a long proboscis, as in this specimen. These insects quickly die in confinement. I placed two in a cage with a lizard, and one was observed to settle on it and apparently suck its blood. I could not induce them to bite my arm.

In Fig. V. A represents the actual size of the tipula, which is bigger than the average mosquito.

The mouth parts are simpler than those of the mosquito. The length of the proboscis consists of three elements : (1) Above is a grooved labrum epipharynx (Fig. V.γ), and in this lies a piercing organ, the end of which is serrated and extends beyond the labrum (Fig. V.β). Below these is a forked organ, which evi-

dently act as a support for them (Fig. V.α). The maxillary palps are in close apposition to the labrum (Fig. V.ε).

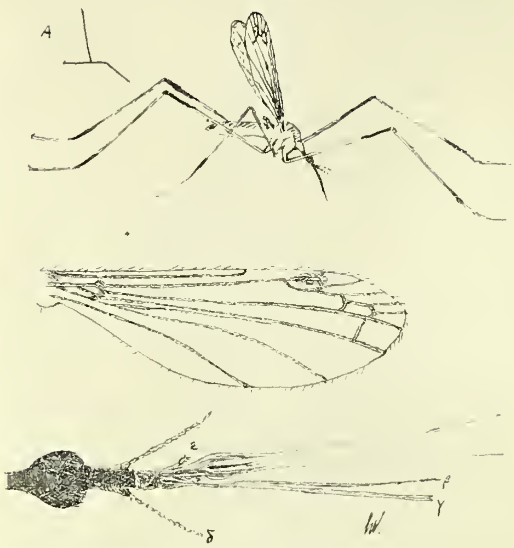


Fig V

Ankylostomiasis.

After malaria, the most important disease in this island is undoubtedly ankylostomiasis. I have made numerous experiments on the ova and larvæ of the ankylostome in an attempt to decide upon the most efficacious means that could be adopted for the prevention of this infection.

It is highly probable that in many cases the only mode of infection is by the skin. Numerous ova are produced by the worm, and these being discharged on to damp earth rapidly develop into active larvæ, which in a day or two grow to their full size. If these come into contact with the skin, they penetrate it and get into the circulation, whence they are probably carried to the lungs, coughed up and swallowed, and thus arriving at the duodenum and upper part of the jejuneum, they develop into adult worms, which by continually irritating and injuring the bowel and secreting toxins, causes the anæmia, pain in the lower part of the chest, breathlessness, and other symptoms characteristic of the disease. This disease only occurs in this island in those who work in earth with bare legs and arms, or who walk about with bare legs. It is therefore most common in agricultural parts, where it is due to indiscriminate defaecation in the "bush" or on the land.

My experiments have been made to decide the action of various materials, drying, temperature, and the sun's rays, upon the ova and larvæ. Observations have also been made on the exact factors in the habits of the labourers that cause infection.

In all experiments faeces containing ova and damp earth in which larvæ had hatched were used; the ova were considered destroyed if they failed to develop in damp earth, and active larvæ if they lost motion and failed to regain it, gradually becoming disintegrated.

First series of experiments.

——	Result.
(1) In sea-water and earth	Ova and larvæ destroyed.
(2) In 50 per cent. sea-water, tap water, and earth	Ova destroyed, larvæ lived two days.
(3) In various masses undergoing fermentation, such as mass of leaves, sour milk, contents of septic tank, &c.	Ova and larvæ destroyed.
(4) $\frac{1}{6}$ per cent. thymol; $\frac{1}{4}$ per cent. β-naphthol...	Ova and larvæ destroyed.
(5) 1 per cent. inorganic acids	Ova destroyed, but larvæ can be immunized to 3 per cent. by gradual addition.
(6) Iron and copper salts, 1—200	Ova destroyed, but not in all cases larvæ.
(7) In sand and water; in fæces and water; in ashes and water.	Ova develop, but larvæ do not thrive and exist for extended periods as in damp earth.

Numerous other bodies, such as lime, cyllin, and carbolic acid, were tested, but both ova and larvæ showed considerable resistance; it required 1-600 cyllin to destroy the larvæ.

In the second series of experiments small areas of ground of four square feet were respectively treated with various solutions and materials, and at the end of a fortnight after 5.3 inches of rain had fallen, samples were taken from the ground and tested to decide if it retained any power of destroying the ova. In all cases except two the ova developed quickly. These were one gram of ferric chloride in ten cubic centimetres of oil to the square foot, and ground which had been treated with a thin layer of tar. No doubt if a large amount of the other not too soluble chemicals had been used, there would have been the same result as in these two, but when the amount reached the degree of absurdity for practical purposes, the drug was not further tested.

The third series of experiments are of much importance, for it shows that both ova and larvæ are very dependent on a certain amount of moisture, and are extremely non-resistant to heat and solar radiations.

Earth was dried for an hour at temperature 60°C., and then placed for two days in a desiccator; liquid faeces containing ova were diluted with five times their volume of water and added to the dry earth in the following percentages :—

——	Result
5 per cent. water fæces and ova added to dry earth	Ova destroyed.
12 " " " "	Ova destroyed.
20 " " " "	Ova destroyed.
25 " " " "	Ova developed.

Faeces containing ova were raised to various temperatures :—

——	Result.
To temperature 105° Fah. for one minute	Ova developed.
" 115° Fah. "	Ova developed.
" 125° Fah. "	Ova destroyed.
" 120° Fah. for one hour	Ova destroyed.

Films of fæces about 1-16 inch thick and containing numerous ova were exposed to the air in the shade, protected from the wind, with temperature 85° Fah., and the pressure of the atmospheric aqueous vapour about 24; drying under these conditions, the ova were destroyed in various experiments in from 1½ to 2 hours.

The same experiments were made with larvæ; 8-12 hours was the length of time required to destroy them.

Further experiments were made on the effect of the sun, the solar radiation at the time being 135° Fah.

Small blocks of fæces about ½ inch in diameter were exposed to the sun; in five minutes all ova were destroyed.

Larvæ exposed in films will resist the radiations, heat, and drying powers of the sun for about twelve minutes.

Now it is impossible to consider all varying factors in these experiments with mathematical accuracy. The conditions of the fæces and earth vary greatly; the question of height above sea level, velocity of the wind, degree of humidity, solar radiations, and atmospheric temperature are a combination of factors each playing a greater or lesser part.

For practical purposes it is sufficient to decide that temperature about 124° Fah. quickly destroys ova; a few minutes' exposure to the sun or even drying in the shade also kills them. As concerns the more resistant larvæ 12-15 minutes in the sun or half a day's drying in the shade will destroy them. The mean solar radiation in this island is about 135° Fah.

We must now consider the manner in which ankylostome infection is usually brought about. The majority of cases that reach the stage when serious symptoms arise may be considered as self-infections. By this I mean that the patient originally acquired one or two ankylostomes from one source or another, and then

continues to infect and re-infect himself by going to the same place in the " bush " or on a cultivation each day to defaecate. In this way he causes a definite and small area to become swarming with larvæ, which on microscopical examination I have on several occasions found in earth taken from these places. I have been shown where they defaecate by a number of patients; they are often extraordinarily conservative in the place they choose.

This system of infection and re-infection is well exhibited in the case of dogs. If dogs that have a few ankylostomes (and almost all in this island have), are tied up in a confined space, they will be dead within two months from this disease. I once obtained four puppies, all of which showed a few ova in their stools; two I allowed to run about, and two I confined in a square boarded place of about 250 square feet. Both of these died in six weeks, and post mortem showed the duodenum and jejuneum to be simply coated with ankylostomes, and this in spite of the fact that the place was well swept out each day. The other two developed no more worms than they had when I obtained them, but upon shutting them up for experimental purposes they soon began to show serious symptoms.

My experiments demonstrate two important points :—

(1) That the ova and larvæ are dependent upon a certain amount of moisture in their surroundings, and that drying or the sun's rays quickly destroys them.

(2) That the majority of cases in which serious symptoms arise are self-infections.

In the country districts indiscriminate defaecation is the rule, not even the labourers' barracks on estates being supplied with latrines.

Regulations might be passed compelling the construction of dry, well-drained trench latrines well supplied with dry earth; these would not cost much and could scarcely be considered a hardship to estate owners. At the same time there must be stringent rules against promiscuous defaecation in the neighbourhood of dwellings. In all cases where sanitary regulations are passed there must be an efficient scheme for carrying them out, such as periodical inspection.

So as to allow drying and the sun's rays to act efficaciously, recommendations should be made for the cutting down of " bush " in close proximity to huts and barracks.

If much infection occurs in towns and villages perhaps the use of sea-water, or tarring the back yards of dwellings, might be within the range of practical action.

In all cases of ankylostomiasis, thorough treatment should be carried out, although we cannot hope to eradicate every worm, however thoroughly the patient may have been drugged with thymol or β-naphthol. I prefer β-naphthol as a drug, for it is less dangerous than thymol, and patients will take it repeatedly, whereas with thymol, once they have taken it they will often refuse it afterwards.

Analysis of Milk sold in the Island.

I have analysed a number of samples of milk sent to me, and from this it can be stated that the condition of the greater portion sold in the island is fraudulent and dirty.

The averages for thirty samples were :—

Fats	1.3 per cent.
Total solids	8.5 ,,
Specific gravity	1024

The deposit from the centrifuge often showed the presence of manure and other foreign matter.

On the other hand, I examined eight samples drawn direct from the cow, with the following averages :—

Fats	3.6 per cent.
Total solids	12.5 ,,
Specific gravity	1031

The highest sample showed 5.6 per cent. of fat and the lowest exactly 3 per cent.

The reason of the low condition of the milk sold is that it appears to be considered legitimate to skim off the fats, which is in demand by certain classes for the hair.

In many cases the milk is actually watered, often not with water from a very pure source. I have known cases where the water was taken from the road-side gutters.

I believe in some cases starchy matter is added to the milk to raise the specific gravity, which is taken by a Town Board constable; this, until recently, was the only test applied.

The milk is hawked around the town in open buckets in which are placed disused oil bottles, and plantain or other large leaves; the former has become the standard of measure, and the latter are to prevent splashing.

I drew up for the Town Board a scheme for the prevention of these various abuses. This included suggestions for regulation cans and measures that would be cheap enough for all classes; also by-laws by which people selling milk below a fixed standard or in a dirty condition could be prosecuted. As the law of the Colony now stands it could be avoided with ease by the majority of offenders.

In this type of country, where fodder varies and cattle cannot always be kept in a good condition, a little lower than the usual standard might be allowed.

Serpent Bite.

This island is unfortunately afflicted by the presence of the deadly *Lachesis Lanceolatus*, which is known locally as the Fer-de-lance.

Some years ago the mongoose was introduced in the hope that it would destroy the serpent, and it has undoubtedly been of great value as a natural enemy to it, so that a study of the mongoose from this point of view brings out many interesting and important factors. These will be discussed later.

The fer-de-lance, it is said, was imported to this island, Martinique, and Guadalope by the French at some time in the 18th century to drive the Caribs, the original inhabitants, out of the wooded parts; whether this is true or not, the snake was evidently originally brought to these islands from the mainland. At one time it had become so numerous that the inhabitants were often obliged to fire their cane-fields before they could reap them. Deaths from serpent bite were then extremely numerous. In a few years after the introduction of the mongoose, the number of snakes rapidly diminished, until none but a few large ones were to be found, these usually being well over six feet in length. For several years there were no deaths from this cause, but during the last two or three years snakes have reappeared, and several deaths have occurred.

The treatment of serpent bites is considered, even by the more intelligent inhabitants of this island, to be best left in the hands of the African or Creole "bush-doctors." From this fact and from the rapidity with which death occurs when a large snake bites (and at the present time almost all bites are by large snakes), the medical men rarely have an opportunity of seeing or treating a bite. On account of this, the widespread belief in "bush" remedies, and the fact that I have received a number of herbs and extracts as reputed cures, I have gone into the methods by which these "bush-doctors" treat their patients with a view to ascertaining whether or not there is any value in them.

The method I have adopted is to prepare an extract from the poison gland of the snake, to ascertain the minimum lethal dose per kilogramme of guinea-pig, then to inject this together with the bush remedy, always, of course, injecting a control.

The halo of mystery that is one of the reasons of belief in bush-medicine does not appear to be very difficult to penetrate.

One or more of the following will always be found to be the methods of the would-be curer of snake bites :—

(1) By some potion or extract of the serpent—the one that has bitten usually being preferred. Most often an extract of the head is given to be swallowed.

    The idea of "Similia similibus curantur" is almost world-wide in its distribution.

(2) By poultices of leaves placed on the bite, or extracts of herbs given to drink.

(3) By general massage; there is undoubtedly a little value in this.

(4) General foolery; this is an inevitable accompaniment, to impress the ignorant patient. The pressing of leaves, rags, bones, or what not on

the forehead or other parts, the burying of some object, the passage of hands, absurd questions put to the patient, fall under this heading.

In my experiments, the poison gland of a large snake was dissected out and ground up with glycerine and water, then filtered through fine muslin; this will preserve its toxicity almost indefinitely.

The numerous leaves, roots, watery or alcoholic extracts that I have obtained or received as reputed cures, were in turn injected or given by mouth to guinea-pigs, together with a minimum lethal dose of the venom extract.

All the results were, as might be anticipated, negative, or the " remedy " has appeared to accelerate death.

The mortality after bites of the fer-de-lance is probably very high, and in this island, now that the mongoose has destroyed most of the smaller and intermediate-sized snakes, with the result that bites are usually from very large serpents, the mortality is no doubt higher than elsewhere. This will act to the detriment of the " bush-doctor," as a part of his reputation is founded on natural cures taking place after bites from smaller serpents.

If the inhabitants could be educated to immediately tie a rope, or any other improvised tourniquet, tightly round the thigh (90 per cent. of bites are on the legs) and then send for a medical man, the chances of life would be greatly increased. As it is, by the time a medical man arrives the poison has become almost completely absorbed. Some planters possess a case containing a small lancet and crystals of potassium permanganate; I am afraid that this toy in their hands is practically useless, as even a moderate-sized snake injects its venom about an inch below the surface. It would be far better if they used a tourniquet and sent for a medical man.

A short time back I attended a patient who had, when I arrived, been bitten an hour before. Although the serpent had been a large one and had stung him in the fleshy part of the calf, the man recovered.

The treatment was as follows: a rope, a few moments after the bite, had been tied just below the knee, it had not entirely stopped the circulation, but had probably been of some value. I placed a tourniquet on the thigh and removed the rope. A strong solution of potassium permanganate was injected into the tissues two inches deep and all around the situation of the bite. A large hypodermic syringe was used. Sal volatile and digitalin were administered to support the heart.

The injured leg and the whole of the body was thoroughly and continuously massaged. I believe this is of value, as it distributes the poison evenly throughout the system, and the muscle action or its serum in some manner appears to neutralise the poison.

The leg was finally cleaned up with antiseptics, a small incision made into the bite, and the tourniquet gradually loosened.

The following experiment lends some support to the impression that massage is of value in serpent bites:—

Four guinea-pigs were injected with the same dose per weight, two were placed in a wire rat-cage where they could hardly move, the other two were taken, thoroughly massaged, and kept moving for about three hours. Both the former died within twelve hours, one of the latter died in forty-two hours, partly from sepsis, and the last finally recovered.

The Mongoose.

A description of the effect of the mongoose on the fauna of this island, its advantages, disadvantages, and limitations, is of importance, especially to those who are considering the establishment of new species to fresh surroundings.

The mongoose was introduced as a natural enemy of the fer-de-lance, and at first it found no competition and an abundant food supply, so it was little wonder that it multiplied at a very great pace. Admirably doing the work for which it was intended, it completely destroyed all the serpents in and around towns, villages, and settlements, and from the immediate neighbourhood of the great majority of the cane and cocoa estates. Apart from this, it has exterminated several birds that nest upon the ground, and other harmless snakes of value as rat destroyers, it has lessened the agouti and iguana to disappearing point, and has greatly diminished those good destroyers of insects—the lizards; besides, it has devoured innumerable rats, until that wily creature altered its methods of living, and made

nests in the trees, and spent the night hunting for food, for the mongoose hunts by day.

This vast amount of food supply being lost or lessened, and that which remains having no doubt learnt to keep one eye on the mongoose, this little animal has naturally started to diminish, and it will continue to do so until some balance is reached between itself and its food supply.

With the ebb of the mongoose there is the flow of the serpent.

The latter for some years had practically ceased to exist anywhere but in the heavy, practically unexplored forest lands, where the mongoose either cannot or will not live and breed; his natural habitat is short, grassy scrub or bush. Had the mongoose been imported into a completely opened-up country, he would probably have exterminated the fer-de-lance. As it is, a balance will be established between the two, and the serpent will never again become the terrible pest he was, but by occasional deaths we shall for a long time to come be reminded of his presence.

The mongoose has been imported to other places as a destroyer of rats, and for flat, unwooded lands such as cane-fields he is at first an undoubted success, but for cocoa estates and woodlands he is the opposite, as he keeps the rats in the trees, where they destroy the cocoa and other fruits. Also this Hespestes is a great slayer of poultry, all small ground mammals, and reptiles, and birds that breed upon the ground. Any Government or person considering his importation should carefully view the fauna and nature of their country to consider his possible effects.

Natural Enemies.

In this report I have described two creatures (the mongoose and " Millions " fish) that have done, and are doing, a great work as destroyers of other creatures inimical to man. A number of other examples could be stated from various parts of the world.

It is time that the inter-relationship of the fauna of each country was more carefully studied with a view to discovering natural enemies and their properties as destroyers of the numerous array of pests that cause a loss or are an actual danger to man.

Judging by the numerous examples of imported species having upset the balance of nature, it is probable that the best species for this purpose will be those that are not indigenous.

Before any but fish or those that pass their entire life in water are imported to a fresh locality, their entire possibilities of breeding and destruction must have been worked out. Already too many cases have occurred in which irresponsible persons have introduced some form of animal or plant life with dire results to the inhabitants. It is time, indeed, that this matter were controlled by law.

I am working out many of the natural enemies of diptera in this Colony. For this purpose I have had made insect cages in which I can regulate the temperature and degree of humidity. The points that I work out in the case of each are :—

(1) Atmospheric conditions under which the creature will live and breed—that is, temperature and humidity.
(2) Its natural enemies and the destroyers of its eggs and larvæ.
(3) Insects that it will destroy and their size; also the approximate weight per diem of the insects devoured.
(4) Its degree of fecundity—this can be expressed in several ways; perhaps the best is to state the number that arises from one in a definite time.

If these factors were worked out in various parts of the world for numerous insect destroyers, it would probably become an easy matter to import a number of them or their eggs to new surroundings to destroy pests in these areas. If a creature is at all suitable to new surroundings it soon multiplies at a great rate, and quickly upsets the balance of nature, and it is this upsetting in the right direction that man should be able to turn to his advantage.

Routine Laboratory Work.

Besides researching into the subjects that have been described, there has been a small amount of what may be called laboratory routine, such as cutting sections, examining blood films, bacterial cultures, and the preparation of vaccines.

Under the last heading there was a successful case of ulcerative endocarditis due to *staphylococcus* v. *aureus.*

I prepared one lot of calf lymph and kept it three weeks on ice and one week at ordinary temperature.

In testing it in twenty-five vaccinations for four vesicles each, I obtained ninety-nine vesicles out of the possible hundred. Thus it can be seen that the calf lymph could be prepared locally, and certainly more cheaply than it is now obtained, if the other islands combined in the matter.

There is a blood parasite in the snake Tête-chien; it is a hæmogregarine, schizogony occurring in the spleen. I hope to work out its life history in the future.

Summary and a suggestion for the better Sanitary Control of the Island.

It is time that there was a better sanitary control of the whole island, and the scheme that I am about to suggest, I believe, would be found cheap and practical, besides having a fair educative value. In these matters the aid of the estate owners and managers is essential, but it will not be obtained if they feel that it is likely to become burdensome or an annoyance to them. Once their assistance is given sanitation will become a subject of their own, and even the more sceptical will soon believe in mosquito and ankylostome theories.

In discussing this matter with one of the principal estate owners, he suggested that for each estate and its surroundings, the owner or manager should be asked to act as a Health Guardian, or whatever recently-sounding name would designate him.

It has been pointed out to me that, even for gross unsanitary offences, estate managers feel themselves powerless, or if they decide to prosecute it means the loss of a day at the Courts besides the other petty annoyances of law. It is therefore essential that there is an Inspector of Nuisances, whose sole duties shall be with sanitary matters and would consist of the following :—

(1) Periodic and regular inspection of all latrines—disinfection if necessary.
(2) Visit yaws localities, to search out chronic cases, which may be acting as persistent infectors.
(3) House-to-house inspection for mosquito larvæ.
(4) To superintend disinfection in cases of pneumonia. (Pneumonia is a very infectious and deadly disease to those races whose ancestors have not been afflicted with it so as to cause racial immunity. I instituted disinfection here in cases of outbreaks, so far apparently with excellent results.)
(5) To visit all calls of Health Guardians, and to prosecute in suitable cases.

The Health Guardians should be supplied with addressed post cards, on the back of which they can report sanitary breaches and request the presence of the Inspector of Nuisances.

Further, I would suggest that each town and village should have a small Board of Health, with powers of dealing with all sanitary matters connected with or affecting the town. They should not necessarily view the town boundary as the limit of their range of action. I have known of a small but dangerous swamp on waste land within a stone's throw of the main street of a town; upon pointing this out I was informed that it was outside the town boundary and therefore outside the action of the town authorities.

In at least two of the villages of this island that I have repeatedly inspected there are small localised swamps which each year cause a number of cases of malaria, yet these places, for the expenditure of a few pounds per annum (say about £8), could be obliterated or controlled.

In the course of this report I have urged certain sanitary improvements, which may be summarised as :—

(1) More definite laws and regulations; as in the case of the milk sold.
(2) That the aid of the more prominent inhabitants is obtained by asking estate owners and managers to act as Health Guardians.
(3) That an Inspector of Nuisances is appointed.
(4) That each village has a Committee of Health.
(5) That disinfectants, ointments, and dressings are supplied to those suffering from ulcers or in an ulcerated condition, and no one shall be allowed to go about with open ulcers and sores.
(6) That estates are required to build dry, well-drained latrines.

Probable cost:—

		£	s.	d.
(1)	Inspector of Nuisances	50	0	0
(2)	Horse and Travelling Allowance	30-40	0	0
(3)	Supply of disinfectants, ointments, and dressings ...	25-40	0	0
(4)	Incidental expenses	10	0	0
		£120-140	0	0

LUCIUS NICHOLLS.

No. 13.

ST. LUCIA.

SUMMARY OF REPORT OF WORK DONE IN CONNECTION WITH THE LABORATORY DURING THE SIX MONTHS ENDING MARCH 31st, 1911.

1. Research work on flies associated with objectionable matter.
2. Further work with " Millions " fish.
3. Further work on ankylostomes and ascaris lumbricoides.
4. Flies, midges, and sandflies that breed in mud.
5. Collecting of biting insects.
6. Distribution of quinine.
7. Some work with " Salvarsan."
8. Laboratory routine.

11th May, 1911.

LUCIUS NICHOLLS.

Report of work done in connection with the Laboratory for the six months ending March 31st, 1911.

During the last six months I have collected and performed numerous experiments with flies and other insects which are found both in association with food and water and human excrementa and other objectionable matter.

In the temperate climates the number of species of flies that are found in these connections is not great, and is nearly limited to the common house-fly (*Musca domestica*), the lesser house-fly (*Homalomyia canicularis*), and a few others of less importance; but in the tropics we meet a vast profusion of insect life, and it will be found that some of the smaller flies for filthiness and probable danger to human beings as carriers of pathogenic germs far surpass the common house-fly, which is now considered by the sanitary scientists of Europe to require serious consideration as a disseminator of disease germs.

It is therefore of importance to bring home to Governments and the general public the array of insect germ carriers, so that it may be thoroughly borne upon them that exposed fæces and other objectionable matter, though perhaps well away from habitations, may none-the-less be a source of danger to health and life.

Most of the labouring classes in this island defæcate in the " bush " in the neighbourhood of their dwellings, and even many of the upper classes appear to have no objection to the accumulation of evil matter near their houses, provided it does not too greatly offend their senses of sight and smell; nor does it appear to have been impressed upon them that these habits are a latent source of danger to them and their neighbours.

It may not be easy for the lay mind to fully appreciate some of the ways by which their food and water can be contaminated by fæcal matter; but all are well aware of the swarms of flies associated with noisome matter, and also that these insects are often seen over water and on food. Thus, in studying the propensities of flies as conveyers of disease, it is an important point to bring the filthy life histories of these insects to the public notice, that a proper horror of them may be instilled into the minds of all—for public opinion formed on a little knowledge in these matters makes it far easier for Governmental regulations.

In all situations in nature which can act as feeding and breeding grounds for insects, a large number of species can at various times be caught, yet it will

be found that only a few have completely adapted themselves to the circumstances of each case, and these alone are always found breeding and feeding in large numbers; *vice versâ* they are not found in great numbers in other places. When the flies that are seen upon exposed stools are collected, they are found to include a large number of species, but only a few will be obtained on the majority of occasions and in great numbers; and these, closely adapted to a single situation, will naturally not often be found upon fresh human food, but being thirsty creatures they are likely to be a source of danger as infectors of water supplies.

The best and most numerous example which I have obtained of these flies belongs to that assortment known as *acalyptrate muscids*, and I will provisionally call it *scatophilus*.

It lives and breeds almost exclusively upon human excrementa, and in exposed places swarms of this little fly will be found. The only other situations in which I have caught it have been water-pools, rivers, and ravines, in very dry weather, and it will fly a considerable distance in search of water. After a long period of dry weather I placed a small pan of water in the " bush " to which labourers from neighbouring huts were accustomed to resort, and in which these flies were consequently plentiful; soon numbers of them were seen alighting on the vessel at the edge of the water and drinking; the next nearest water was about one hundred yards away, and here also the flies were seen. The pan of water was left here for several hours, it was then removed and examined for fæcal contamination by means of cultures, and *bacillus coli communis* was obtained. This experiment was conducted upon two other occasions, but only in one of them was this intestinal organism grown. Needless to say the vessel and water used were previously sterilised, and that samples from it were placed in sterile bottles. I have not been able to again repeat these or to carry out further experiments, as a period of dry weather is essential for the water to attract the flies.

If the contents of the stomach of these flies is examined it will be found to consist of pure fæcal matter, so much so that in one hundred flies examined, twenty-six had in their digestive tracts the ova of *ascaris lumbricoides*, *tricocephalus dispar*, or *necator americanus*. This is very different from some other flies, such as *sapromyzidæ theobromæ*, which search for *undigested particles of starchy food, but do not indiscriminately engorge the filth.

Scatophilus is a dusky-looking fly, three to three and half millimetres in length ($\frac{1}{8}$ inch approximately). The abdominal segments are very dark in colour, but basely banded a yellowish brown; the legs are an alternating mixture of black and yellow, and upon the head and thorax there are small light grey areas. The venation of the wings is peculiar; next to the incomplete fourth longitudinal there comes a complete false nervure (Fig. Ic), and the last longitudinal vein is completed as a false nervure. The halteres are long and prominent. (Fig. IA. B=actual size.)

It lays its eggs upon pure fæcal matter and they hatch out within twelve hours. In three days' time the first of the larvæ are seen moving away. They possess the "hold and let go" mechanism, and by means of this they hurl themselves into the neighbouring grass, which affords a protection for them; here they pupate.

Two points appear characteristic of all flies that breed in stools: (1) Their larval period is short, and is followed by a much longer pupal period; (2) They all attempt to get well clear of their breeding ground and to crawl into protected places; some of them, such as members of the family *Muscidæ*, will wander about for more than a day, and will travel many yards to find a suitably protected situation in which to pupate. Under stones and in the grass surrounding fæcal matter pupæ of various flies can always be found.

I placed a stool which had been exposed to flies in the bottom of a nine-inch beaker; this was then put into a fly cage; over six hundred maggots succeeded in getting out of the beaker and pupating under stones and elsewhere in the cage; only a few eventually pupated in the beaker. Of these six hundred half were *Scatophilus*, the rest belonged to the families *Muscidæ* and *Anthomyidæ*.

Among those that I have found breeding in stools is a small, wingless fly, belonging to the family *Phoridæ*. I have here illustrated it. (Fig. II.)

Swarms of minute flies are always seen upon manure heaps. I have not succeeded in breeding them in pure human excrementa, and I do not believe that they ever breed in this situation, nor are they seen upon food, but in dry weather they are numerous around water pools.

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* Labourers that eat large quantities of various farinaceous foods often discharge large particles of undigested material.

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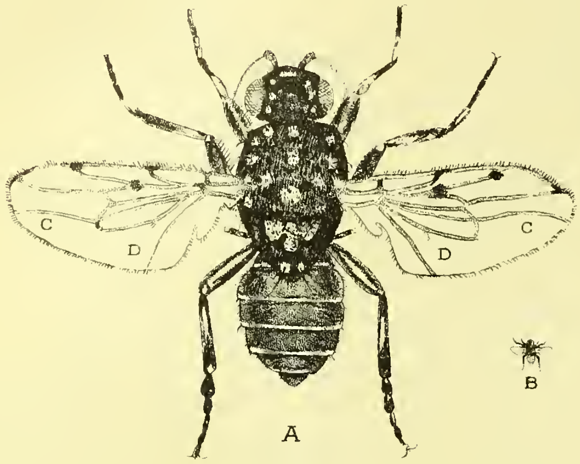

Fig. I.
B = Actual size.

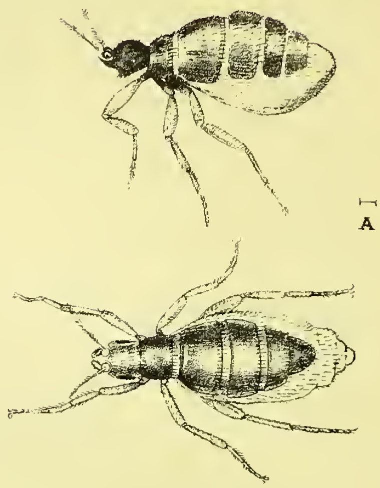

Fig. II.
A = Actual size.

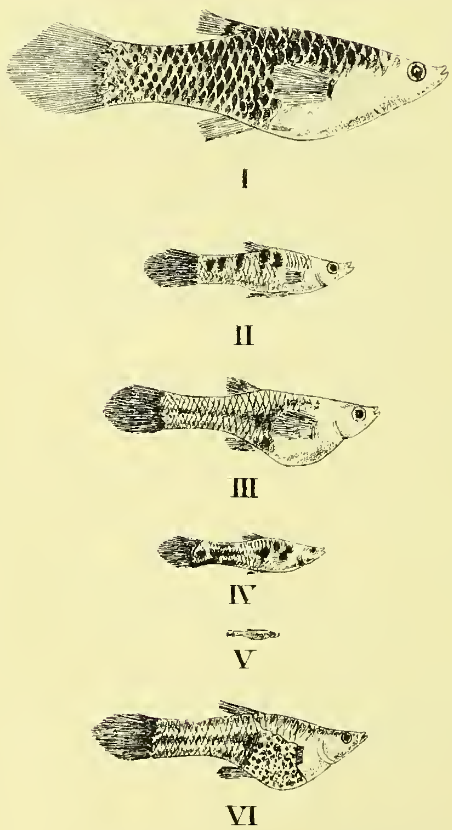

Fig. III.

I Pregnant female of larger variety of "Millions" fish.
II Male of larger variety.
III Pregnant female of smaller variety of "Millions" fish.
IV Male of smaller variety.
V Size of new-born fish.
VI Showing numerous young in "utero".

Again, there are numerous flies associated with an assortment of decaying matter, which from their long larval period could not breed in exposed excrementa, although they will breed in septic tanks or cesspools; among these might be mentioned *Eristalis* and other *Syrphidæ*, of larval periods of more than a month. The following is a list of flies I have recently studied, arranged to show their approximate possibilities as infectors of man. I employ four plus signs (+ + + +), indicating that they are the greatest carriers of infection of the flies in this list. Thus *Musca domestica* is the greatest carrier to food, *Scatophilus* to water, and *Helkoplassa* (ἕλκος-πλάσσω) from ulcers or eruptions to abrasions; the great importance of this last fly I have described in a previous report,* calling it the Ulcer fly.

——	Infecting food.	Infecting water.	Ulcers and eruptions to abrasions.	Breed in pure fæcal matter.
(1) *Musca domestica*	+ + + +	+	+	Occasionally.
(2) *Sapromyzidæ helkoplassa* ...	O	?	+ + + +	Never.
(3) *Scatophilus*	O ?	+ + + +	O	Always.
(4) A large muscid (x)	+ ?	+ + +	O	Usually.
(5) A small muscid (y)	+ ?	+ +	O	Usually.
(6) *Sapromyzidæ theobromæ* ...	+ +	O ?	O	Occasionally.
(7) *Homalomyia canicularis* ...	+ +	+	O ?	Occasionally.
(8) *Homalomyia II.*	+	+	O	Occasionally.
(9) *Lucilia I.*	O	+	O	Usually.
(10) *Lucilia II.*	O	+	O	Occasionally.
(11) *Stomoxys calcitrans*	O	?	+ ?	Never.
(12) Small black acalyptrate ...	?	+	O	Always.
(13) Minute manure flies	O	?	O	Never ?
(14) *Phoridæ*, winged ... ... (15) *Phoridæ*, wingless	+ ?	O ?	O	Occasionally.
(16) *Psocidæ*	?	?	—	Once found breeding in a stool.

No doubt many flies, even though occasionally found in objectionable situations, can be practically neglected as carriers of pathogenic germs; but all insects found in human habitations, and which are known to devour excrementitious matter and to come into contact with human food and water, are worthy of notice, even such as ants, cockroaches, and *psocidæ*. I have found the former of these carrying material from latrines to their nests.

The *psocidæ* are often extremely numerous in latrines and pantries, four or five species being sometimes found within an area of a few square feet, and ranging from those with large, hairy wings to those entirely wingless. They are never common in the same house in which ants are numerous, for the latter are easily able to capture these minute, unprotected creatures.

I have obtained *bacillus coli communis* from individuals of these three classes of insects.

Flies undoubtedly play a great *rôle* in countries where dysentery, typhoid, cholera, various worms, yaws, ulcers, small-pox, &c., are common; and when we consider how often tubercle bacilli are found in the fæces of tuberculous patients, it is quite probable that even such a disease as this may at times be conveyed to the uninfected by the agency of flies.

"*Millions*" *Fish.*

In my previous reports I have described much work that has been carried out in distributing and protecting "Millions" fish in a large number of various localities which breed mosquito larvæ. This work is being continued with successful results and at an exceedingly cheap rate.

I include a drawing of the two varieties of "Millions" fish. The first, depicted in Figure III., is a large pregnant female of the Vieux Fort variety; the drawing is actual size. Figure III., No. II. is a male fish of this variety; it does not often exceed the size of the drawing. The males of this variety are of sombre colours, and very different from the other smaller and more common kind, in which the males scintillate with all the colours of the rainbow, and there are three well-marked red blotches upon the body; in a full-grown, well-fed sexually mature male there is at the base of the tail fin a marking like those on peacock feathers. It must be noted, however, that in times of drought, when there is little food for them and their

* No. 12.

pools have shrunk to small dimensions, the brilliant colouring and markings of the males become very faded and obscure. Fig. III., Nos. III. and IV. illustrate (to size) male and female of the smaller variety; No. V. is a new-born fish; No. VI. is a pregnant female opened to show the pseudo-uterus full of young.

I find this smaller variety the more useful of the two for distribution, as it breeds more quickly and flourishes in a greater variety of surroundings.

Ankylostomiasis.

But little more than a decade ago this disease received but little attention Now that much research work has been done, it is found that throughout the tropics, with the possible exception of malaria, it plays greater havoc with life and health, and consequently with labour, than any other disease. Neither is this disease confined to human beings, but in its other forms it destroys a large number of the more important domestic animals of man.

I have gone carefully into the matter in this island, and have examined microscopically a large number of specimens of excrementa from man and animals. My results show:—

That all labourers in the country districts harbour the parasite, and many of them show more or less severe symptoms of the disease.

That all dogs harbour their variety of the parasite, and the miserable condition and the short life of the majority of them is entirely due to this worm.

That in certain low-lying districts this disease is very common among sheep, and often after wet weather produces a great mortality among them.

That a large number of horses are afflicted, which occasionally reduces them to a wretched condition.

On one estate that I visited I found the dung of all the horses and sheep to show numerous specimens of ankylostome ova. I performed a post-mortem on one of the sheep that had just died; the duodenum was laden with ankylostomes engorged with blood; even the abomasum contained numerous individuals. The worms were present in all stages of development.

This estate was in a low-lying district, and after the wet weather the owner lost a very large number of his sheep from these parasites.

As far as human ankylostomiasis is concerned, the entire absence of any latrine accommodation upon all estates is one of the principal reasons of its great prevalence in country parts.

For the disease in cattle the education of owners to the cause of the loss of condition of their animals and a cheap supply of thymol for the destruction of the worm should be the first steps taken.

Ascaris lumbricoides.

As I have previously shown by numerous experiments, which were described in a recent report, sunlight and dryness are the great destroyers of ankylostome ova and larvæ. I have carried out similar experiments with the ova of the round worm, *ascaris lumbricoides;* the test as to whether the ova are alive or have been destroyed depends upon the fact that under certain conditions they will undergo partial development. Thus small portions of fæces in which ova are numerous are exposed to various degrees of dryness or sunlight; they are then placed in test tubes in which is a solution of 1·5 per cent. hydrochloric acid; these are put into an incubator; at the end of twenty-four hours the acid solution is filtered off, and the solid portions left are shaken up with normal saline in which is a trace of caustic soda; again it is incubated; at the end of twenty-four hours it will be found that many of the ova have reached the mould stage, and in some a small, perfectly developed worm can be seen in the egg case. If by this time no development has taken place in the egg it is considered that it has been destroyed.

To state briefly the results of the experiments:—

The ova of *ascaris lumbricoides* will survive a degree of drying and temperature greater than that withstood by the ova of *necator americanus*, and about equal to that withstood by the larvæ of this ankylostome.

Insects breeding in mud and earth.

Judging by the results of numerous experiments, the number of flies, midges, and sandflies that breed in liquid mud or earth is very great. For obtaining specimens of these I use a box in the top of which are fixed numerous tubes, which are plugged. The box is placed over muddy areas, and any insects that hatch out

will seek the light, and thus come into the tubes, from which they can easily be removed by unplugging and quickly inserting a test tube over them.

It appears, from the numbers that I have collected, that these classes of insects more often breed in mud and earth than in water.

Among other work, apart from the usual laboratory routine, has been further collecting of biting insects, work on Fer-de-lance venom, and the action of " Salvarsan " on yaws and syphilis.

LUCIUS NICHOLLS.

No. 14.

ST. LUCIA.

LABORATORY REPORT FOR THE HALF-YEAR ENDING SEPTEMBER 30TH, 1911.

(Received 28 November, 1911.)

I. During the last six months I have devoted much time to work in connection with yaws. There is, therefore, included in this report an essay embodying numerous points which I have been able to elucidate, a complete analysis, in four charts, of all cases which have been isolated since the opening of the Asylum in 1882, and a few illustrative drawings and photographs. Unfortunately, the records have not been uniformly well kept; in a few cases even the age and sex of the patient have not been stated, consequently the total of the patients is not the same in all the charts. This, however, is not of great importance.

II. Among other research work, apart from laboratory routine, I have carried out numerous experiments with flies which breed in noisome matter, and I believe that I have conclusively demonstrated that flies cannot carry a pathogenic organism through the phases of their development.

Thus, if flies lay eggs in matter containing the bacillus of typhoid or one of the germs of dysentery, though these organisms may be present in the resulting maggots or even in the early stages of the pupal development, they will certainly have disappeared in all cases before the emergence of the flies. This is of great importance on account of the array of flies breeding in objectionable material, for it shows that food or water can be infected only by adult flies acquiring the organisms during their imaginal period of life.

As the details of the experiments necessarily contain continual reference to unsavoury subjects which have sufficiently figured in my last report, I have decided to publish them elsewhere.

III. The distributions of " millions " fish and quinine, as aids to malarial prophylaxis, proceed satisfactorily, and are undoubtedly showing good results.

IV. The laboratory routine has included blood examinations, preparations of vaccines, work with blood-sucking insects, examination for intestinal parasites in man and animals, and milk analysis. The regulations for the sale of milk still remain very unsatisfactory. The samples of milk which I have received have often been greatly diluted and very dirty; in fact, I believe among many vendors the dilution of milk, often with water from an objectionable source, is the rule. This and general ignorance account for the fact that in this island a child rarely, if ever, survives if its mother is obliged to wean it at an early age.

YAWS (*Frambœsia Tropica*).

The disease is known throughout the British colonies as yaws or frambœsia. The latter term, derived from the French " framboise," was first used by Sauage in 1750 on account of the raspberry-like appearance of the eruption.

In the French colonies the disease is called " pian."

In all parts of the world where frambœsia occurs there are in use a number of local names; often these refer to different periods or manifestations of the disease. It appears that in some cases this has given rise to the opinion that there exist a number of diseases closely allied to yaws.

In this Island the scaly patches are known as " pian dartres," the developed yaw is called " tubba " or " crabs," any very large element of eruption is called " maman pian " (mother yaw); but I have known this term to be used referring to the first appearing granulomatous element, which often points to the site of inoculation.

Geographical Distribution.—Yaws is widely distributed throughout the tropics, especially in the more humid parts; thus the mountainous and wooded ocean islands show a greater prevalence of the disease than the drier parts of the continents.

It is common on the west coast of Africa, where it is known as "gattoo." It is stated to be present in the humid parts of Uganda and among the kaffirs of South Africa. It is rarely seen in the northern parts of Africa. It is prevalent in the islands of Madagascar and the Comoros.

It is very common in the West Indies and the northern tropical countries of South America, where it is known as "bubas."

Yaws occurs in the islands of the Pacific Ocean—Fiji, New Hebrides, and Samoa—and the local names applied to it are "coco," "tonga," or "lupani tona."

In Asia it is not common in the larger countries such as China or India, but in the islands such as Ceylon (where it is called by the natives "parangi"), the Philippines, in Assam, Siam, Java, and the Malay Peninsula it is prevalent.

History.—The history of any disease is a subject of much difficulty, for the descriptions of morbid processes which occur in ancient writings are of such a nature that often it happens that a number of writers will each of them refer a different disease to the same description.

The powers of the ancients in diagnosing diseases of the skin may have been great—they probably were not; but it is certain that they possessed little or no ability for describing them for the use of future generations. The result is that medical writers of more recent times have produced much chaos under the impression that the ancient description must refer to a separate entity. Even in recent times yaws and syphilis have been confounded by a number of medical men; therefore, it is not to be expected that a disease of this nature can possess a very concise history. Certain writers have referred yaws to the Arabian word "sahafati" and even to the Hebrew word "sâr á áth"; the latter, when it refers to a human malady, might be freely translated as "a skin disease." It has been the happy hunting ground for would-be medical philologists. It occurs nearly thirty times in the Old Testament, and the early translators by the wrong use of the word leprosy have caused it to appear that it referred to the disease which now goes by that name.

The first unequivocal mention of framboesia did not occur until after the discovery of America, when in the early part of the sixteenth century it is mentioned by Ovieldo y Valdez. In the seventeenth century it is reported by Piso, Rochoforte, and Raymond Breton as occurring on the South American continent and in the West Indies, where it affected the Caribs. Labat seems about this time to have confounded framboesia and syphilis. In the early part of the eighteenth century the disease was first described from other European colonies such as Java and Sumatra.

In the slave days yaws became very rife and the planters were obliged to institute yaws houses for the isolation of the afflicted. Sir Patrick Manson states that since the emancipation of slaves the disease has become more prevalent "and is now a principal and loathsome feature in the morbidity of these islands."

Aetiology.—Numerous bacilli, micrococci, and even yeasts have been described by different observers as the possible causative organism of framboesia.

In 1905, by staining very deeply with Giemsa's stain, Castellani demonstrated a Treponema, and this is now generally accepted as the true organism of the disease or as a phase in its life history.

This organism has received the name "*treponema pertenue*," and it is very variable in appearance and size. It ranges from about 7μ to 25μ in length, and, although generally a very narrow and delicate organism, some of them appear much thicker. When seen with the dark ground illumination its shape may be compared to that of a pulled-out corkscrew, though the number and even length of the spirals are very variable, more so than is the case with "*treponema pallida*." Again, it is very variable in its propensities for taking up stain and often it does not stain evenly. Occasionally small granules can be seen at the end or in the continuity of the organisms; these are probably signs of degeneration, for they are more common in the later stages of the disease and after treatment with mercury or "salvarsan" has commenced.

It is extremely difficult to describe morphologically the differences in such a delicate organism as this and in *treponema pallida* of syphilis, yet the impression

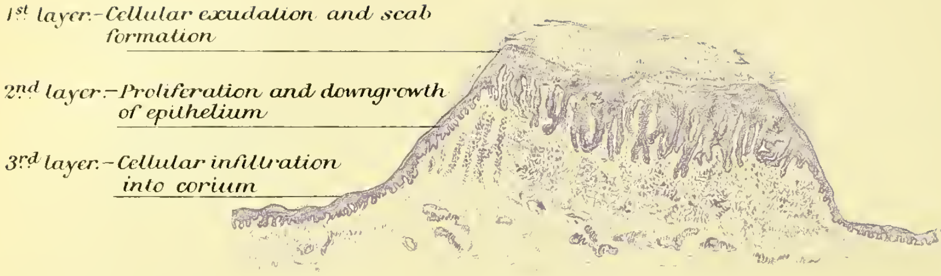

Fig: I.

Section through granuloma

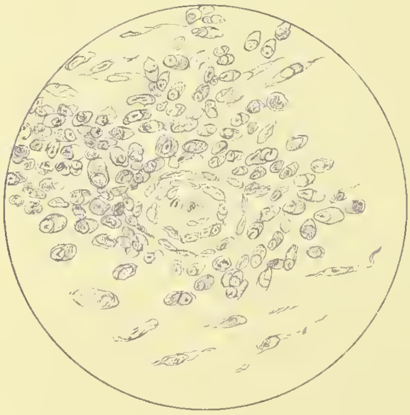

Fig: II.

Shows small vessel in late stage of granuloma ***without*** *perivascular or endothelial cell proliferation, surrounded by much cellular infiltration, the cells being principally "plasma" cells*

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would be left with the majority of bacteriologists after a number of specimens had been examined that they were two distinct organisms.

The proof that they are two distinct organisms lies in the fact that those who have had syphilis and become immune to inoculation can still contract yaws. This was actually demonstrated by Charlouis, who inoculated a Chinaman suffering from yaws with *treponema pallida* and the inoculation was successful. Neisser and Prowazeth in Java and Castellani in Ceylon have repeatedly demonstrated that monkeys which have become immune to yaws are not immune to syphilis.

Treponema pertenue can almost always be demonstrated in the papular stage and in the granulomata; it may be found when these have broken down together with other organisms of the same group and with numerous pyogenic cocci and bacilli. It has been demonstrated in the spleen, lymphatic glands, and even in the bone marrow. In prolonged searching through one hundred and fifty slides of blood smears I saw this organism in two of them.

Inoculation experiments in men and monkeys, besides conclusively demonstrating that syphilis and yaws are two distinct diseases, are of importance in throwing light upon the length of time of the period of incubation. In 1848 Paulet inoculated fourteen negroes with the secretion from yaws nodules; all of them developed the disease in twelve to twenty days, in ten of them an initial sore appeared at the site of inoculation.

In 1881 Charlouis performed a like series of experiments on thirty-two Chinese prisoners, and twenty-eight of them developed a papule at the site of inoculation after fourteen days; the other four did not contract the disease.

In a number of reported experiments with monkeys, who are naturally less susceptible to the disease than human beings, the inoculation period varied from sixteen to ninety-two days.

HISTOPATHOLOGY.—The microscopical changes in the papules and granulomata of yaws have been investigated by Unna, Macleod, Schüffner, Marshall, Shennan, Ashburn, and Löhe. The differences observed in the papules and granulomata are more of degree than of kind.

The first change is a proliferation of the surface epithelium, quickly followed by cellular infiltration into the corium; this epithelial proliferation gives rise to a heaping up of these cells, and numerous downgrowths of elongated columns of cells appear as if penetrating into the corium.

Naturally in this overgrowth of cells numbers of them are seen vacuolated and degenerating, especially those furthest away from the blood vessels of the corium.

A microscopical section of a granuloma can be divided into three layers :—

(i.) The crust or scab layer, consisting of epithelial, leucocytic, and other cellular detritus embedded in exuded serum.

In the older granulomata there is less formation of this nature, but cellular proliferation and hyperkeratosis may cause a great heaping up, protruding an inch or more from the surface.

(ii.) The epithelial layer, consisting of overgrowths and downgrowths of epithelial cells, and among these there occur small areas of leucocytic infiltration.

(iii.) The layer of cellular infiltration into the corium. The cells are those which are usually seen in inflammatory processes :—Polymorphonuclear leucocytes, connective tissue cells, large and small mononuclear leucocytes, mast cells, and plasma cells; in the older lesions there are occasional giant cells. The plasma cells preponderate greatly in the later stages, and Pappenheim's methyl green pyronin stain forms a very pretty and characteristic picture. (*Vide* Fig. I. and II.)

The following are the three main differences between the microscopical skin changes in yaws and syphilis :—

(i.) Yaws shows greater changes in the epithelial layers, whereas in syphilis the changes are chiefly confined to the corium and deeper layers, and there is far more tendency to break down.

(ii.) The characteristic perivascular mononuclear infiltration and endothelial proliferation of the walls of the blood vessels in syphilis is practically absent in yaws. (*Vide* Fig. II.)

(iii.) The giant cells are more common in syphilis.

In sections stained by Levaditi's method or one of its modifications, the treponema of yaws are most common in the epithelial layers.

When the crusts of the granulomata are removed and smears taken from the underlying bloody exudate, and these are stained by any modification of Romanosky's method, there is seen to be alterations in the appearance of the erythrocytes; they are very variable in size and shape, they stain unevenly, some staining even a deep blue, many of them show dots very like those known as Schüffner's, which are seen in malaria.

There are occasionally seen in smears stained by Giema's method small bodies about 4 in diameter, which stain blue, and in the interior of these are numerous small oval or round bodies staining a brilliant red. These are sometimes so beautifully defined and recall phases of protozoal organisms, that the possibility is conceived of them not being derived from the tissue or blood cells, but that they may be one phase of the causal organism of yaws.

Predisposing Causes.—When the tables given at the end of the report are summarised they show :—

(1) *Sex incidence.*—61·3 per cent. of cases admitted to the yaws asylum are males, 38·6 per cent. are females; and as in the population of the island the females preponderate over the males, the percentage liability to yaws works out at 66 per cent. for males and 34 per cent. for females. (*Vide* Chart A.)

Males are, therefore, nearly double as liable to the disease as females.

(2) *Age incidence.*—60 per cent. of cases admitted to the asylum occur before the age of sixteen; thus many more cases occur in the earlier than in the later decades of life, but as the numbers of the population naturally preponderate at the earlier ages, the percentage liability to yaws for each decade of life must be worked out by a mathematical comparison with the average census returns for the years dealt with. They are as follows :—

—	Ages.					
	1–10.	10–20.	20–30.	30–40.	40–50.	50–60.
Percentages for each decade	43·63	26·14	12·93	11·51	4·53	1·16
Percentage liability for each decade	27·6	21·6	14·2	20·4	11·4	4·4

These figures show that through life there is a progressive lessening in the incidence of and liability to yaws. There appears to be one exception, namely, between the ages of thirty and forty. This may be due to the fact that some persons are admitted who have ulcers due to having previously contracted yaws, and that at this age the natives are very liable to contract ulcers. Perhaps there is an error in the ages between twenty and thirty due to patients of this age objecting to the sedentary, regulated, and isolated life of the asylum, and therefore avoiding detection and isolation.

(3) *Relative occurrence in towns and rural districts.*—Chart B shows the practical absence of the disease from what must be considered the only town in the island. Certainly there is far more over-crowding in this town than in any other part of the island. In the nature and cleanliness of the habitations there is little to choose between country and town.

The chart further shows that yaws is essentially a disease of the estates and country parts, especially in those places where about a hundred or more individuals are gathered together in what are known as labourers' barracks. These, however, are rarely over-crowded. This relative distribution of the cases is of importance, as it is the clue to much which has been obscure in the disease. This and its prophylactic importance will be discussed later.

(4) *Effect of rainfall.*—When all due allowance is made for the irregular manner in which patients are admitted to the Yaws Asylum, and for the frequent attempts to avoid isolation, there is still, as shown by Charts C 1, 2, and 3, an extraordinary relation between the amount of rainfall and the admission of yaws patients.

It will be noticed from Chart C 3 that the number of admissions rises about two months after the rise in rainfall, and almost parallel to the rainfall curve. This period of time is about what we would expect, if we allow periods for the contraction of the disease, the incubation, and the discovery and isolation of the patient.

(5) *The person affected.*—The better class Europeans and natives rarely, if ever,

contract this disease; it is almost exclusively confined to the country labourers and their children. The disease is very common among the East Indians, the average number of these people in the island has been about 2,500. I attempted to decide from the records the relative incidence between this people and the negro and coloured population. Unfortunately the records were not sufficiently well kept, but judging by the more or less obvious Indian names, the East Indian coolie, who is almost exclusively employed upon the estates, is considerably more liable to the disease than the Creoles.

The sex, age, relation of town to rural districts, the effect of rainfall and the absence of the disease from temperate countries, are all explainable by three ever-present factors in yaws localities :—

(i.) Nakedness.
(ii.) Liability to small injuries and abrasions of the skin.
(iii.) The presence of flies which feed upon the physiological and pathological discharges of the skin.

The first and second of these are more or less dependant upon one another, and will be considered together.

(i.) and (ii.). Even in the most recently occupied Colonies an indecent lack of clothing is strictly tabooed in the towns and villages, and in the more civilised communities of the tropics the body is as completely covered as in those parts of the world where the low temperature has always obliged the inhabitants to seek this protection. But in the country districts it is a very different matter; nakedness of the feet, legs, and arms is the rule, and very often the labourers work uncovered to the waist; the children work or play around the huts or barracks either entirely nude or with one very slight article of clothing. The covering of the girls and women may often be scanty, but it will always be more than with the men and boys, and naturally adults will be far better clothed than children.

This lack of clothing renders the people very liable to small abrasions, especially on the arms and legs. Thorns, cutting grasses, pointed sticks, and other more or less sharp objects are continually inflicting minor injuries upon the labourer and his children as they work or play in the " bush " and cultivation. On all occasions on which the men, women and children of estates are examined, at least one small injury inflicted in this manner will be found; especially is this so on sugar estates, for the leaf of the sugar cane possesses a sharp cutting edge.

Women, from their more hesitant natures, will be less liable to these injuries than the naked children or the men.

Nakedness is the chief reason why yaws and certain other diseases are so prevalent in warm countries, yet practically absent from the temperate climates.

The wet weather acts in three ways:—

(*a*) There is an increased production of abrasions: this is very noticeable, and is probably due to the wet increasing the adherence of the grasses and other foliage. Anyone who has walked through the bush in the wet weather will have noticed how difficult it is to get thorns and cutting grasses away from one.
(*b*) The wet weather prevents the quick healing of small injuries, due to these being continually wet or moist, also all dressings become soaked by the rain: the increased attendance at the dispensaries during the rainy season for ulcers and septic sores is very noticeable.
(*c*) Wet weather is favourable to the increase of the ulcer fly and the common house fly.

It has been conclusively proved that yaws cannot be acquired through the unbroken skin. On four occasions I have smeared the exudate of nodules, which showed treponema upon the unbroken skin, and this was allowed to remain for several hours, the disease did not develop: if this same secretion had been allowed to come in contact with an abrasion of the skin the disease would undoubtedly have appeared, as shown by the experiments of Paulet and Charlouis.

(iii.). In the West Indies I believe the majority of cases of frambœsia are caused by a certain little fly inoculating surface injuries. I have described this fly elsewhere and called it the ulcer fly, and suggested the name *sapromyzida (?) helkoplassa.* This fly feeds only upon the skin discharges of man and animals. There are very few to be seen in the town of Castries, and these only on the outskirts of the town. They are very numerous in country districts, and can be seen hovering

around the bare legs and arms of the labourers, searching for abrasions and possibly the secretions of the sweat and sebaceous glands.

In cases of yaws, leprosy, syphilis and other conditions in which there is considerable discharge from extensive areas, they swarm around the patient, especially so during the wetter seasons of the year, when they are very numerous.

The fly is about one and a half millimetres (1-16 inch approximately) in length and less than one millimetre in breadth.

Its colour is a mixture of black and yellow—the dorsum of the body and the whole of the thorax being a shining black—the legs, antennæ, mouth parts, halteres, and under distensible portion of the abdomen are yellow.

There is a metallic shine upon the wings. The antennæ appear to consist of three not easily definable segments with non-terminal aristæ. The wings, when closed completely, overlap one another and reach well beyond the tip of the abdomen; their venation is composed of five veins running longitudinally with two transverse veins situated between the third and fourth, and four and fifth, respectively: fine hairs extend around the entire margin of the wing.

The persistence of this little fly is extraordinary. As soon as an abrasion occurs or an ulcer is exposed numbers of them immediately alight upon it, and they must be brushed off by actually touching them, and they will immediately return; they even try to insinuate themselves under dressings. They engorge themselves with pus, blood, serum, and sebaceous secretion, until their abdomina are greatly distended. The distance which they will fly in search of food may not be great, but they will follow a man or animal which affords them an abundance of food a long way.

The yaws asylum is an excellent place to study the ulcer fly; every exposed and moist ulcer and sore has innumerable flies upon and hovering around it. The eruptions of yaws tend to become very hard and dry; the flies can be seen searching all around them, and if the scab is by chance or purposely removed or even slightly raised so that a little serum, blood or a moist surface is exposed, they will immediately feed upon it, almost forcing their probosces under the scab. The hard dry surface they cannot feed upon.

They continually pass from patient to patient, and any visitor to the yaws asylum is carefully searched for skin abrasions by these little pests.

They also feed upon the skin discharges of dogs, horses and mules.

I have frequently isolated pyogenic organisms from these flies.

It appears that these flies breed in the damp soil of pastures and savannahs. Unfortunately I have not been able to breed them in the laboratory.

It is noticeable how much fewer these flies are at Victoria Hospital; sometimes they cannot be seen at all.

It is highly improbable that any blood-sucking insect, such as a mosquito or sand-fly, would be able to convey yaws from one person to another. One hundred and fifty blood smears, taken from thirty patients at various stages of the disease, were stained by Giemsa's stain and exhaustively examined; only in two of them was I able to demonstrate the treponema; this is very different from what is often seen in the superficial layers and discharges of the eruptive elements.

To summarise the predisposing and determining causes:—

> Yaws is essentially a disease of agricultural and country districts; males are double as liable to the disease as females; the earlier decades of life show a greater liability than the later; more cases occur during the wet than the dry seasons of the year; nakedness predisposes to numerous skin lesions, which are essential for the acquisition of the disease, for if any of the secretions from the skin eruptions of infected persons come in contact with these lesions the disease will be acquired; the ulcer fly is probably the agent which carries these secretions in the majority of cases, but from the nature of the case the secretions may be brought to these lesions in other ways, by actual body contact or perhaps by exchange of clothing.

For the purposes of description the course of the disease may be divided into three stages:—the primary, though usually present, is not always very definite, the secondary stage, when the principal manifestations of the disease appear; and the tertiary, a very arbitrary division and not very pronounced in more than one per cent. of cases, is due to a combination of circumstances—these will be described later.

The Primary Stage.—There is an incubation period, which has been variously given by different writers as ranging from two weeks to six months. The latter

figure is far too large and has been given because the inoculation experiments, the initial sore, and the early manifestations of the disease have not been sufficiently taken into consideration. Even monkeys, which are less susceptible to the disease than man, usually show signs of the disease within one month.

The incubation period in the majority of cases is between twelve and twenty days, but it may be a few days longer.

As with syphilis there is almost always a primary sore, but this may be extremely small; it occurs in some small surface lesion or perhaps in a large ulcer, and when it is in this situation the changes which take place may be easily overlooked.

When the site of inoculation is a very small injury, the sore appears as a small papule, which quickly enlarges and develops a crust upon the apex. Sometimes several appear and, coalescing, form a single body covered by a crust.

It shows less tendency than the elements of the secondary eruption to form granulomata, but this may take place. Patients in the secondary stage will occasionally point to a primary sore and call it "maman pian."

The primary sore may be painful on pressure or there may be puritus around it, which has caused the patient to scratch the area and thus accentuate the sore.

Appearing with this sore there may be pains in the limbs and joints, headache, general malaise, and an irregular temperature; sometimes the patient is totally unable to work and has gastric disturbances and diarrhœa, but these graver symptoms are usually due to the concomitant development of the malarial parasite. The neighbouring glands become enlarged and hard.

The primary sore is usually situated on the exposed surfaces, such as the legs or arms, but it may occur anywhere, as when young children infect the mammæ or other parts of the bodies of their mothers.

The length of time that the sore lasts is variable and depends upon the site in which it developed and whether it has been irritated or treated by herbs or scarifying by the patient or his friends.

When it appears in an old ulcer, the ulcer may become a large fungating mass, and if situated on the front of the leg may implicate the periosteum of the shin-bone, causing a heaping up of osseous tissue. Under these circumstances it may last until the eruption of the secondary stage has disappeared and finally heal, leaving a large scar adherent to the bone. Usually it heals soon after the secondary eruption has appeared.

The Secondary Stage.—This comes on four to eight weeks, usually about six, after the first appearance of the primary stage.

The skin loses its natural gloss, becomes harsh and rough, and may show numerous furfuraceous patches; these are sometimes very noticeable, the superficial layer of the skin forming a kind of attached scurf. This condition is often very pronounced in children and exists throughout the secondary stage, and may be well marked long after the yaws have disappeared.

Small papules appear on various parts of the body, and soon develop a small yellow crust on their apices.

The size of the majority of these remains about two millimetres in diameter throughout the course of the disease.

Others become larger and develop into the large typical granulomatous nodules, covered with thick irregular dirty yellow crusts, which are formed of debris from the proliferating epithelium, dried exuded serum, and numerous inflammatory cells. If this crust is removed another quickly forms on the exposed surface, which has the fungoid appearance of ordinary granulating tissue, but is of a very different nature.

The eruption may or may not be painful to pressure, this depends to some extent on the situation; they are always tender on the plantar surfaces of the feet.

When the crusts are removed the surface can be scraped without producing pain; this is because of the protection afforded by the thick pad of proliferating epithelium.

There may be much irritation around the papules and granulomata.

Situation.—The granulomata may appear in the skin on any part of the body, but they are most common on the exposed surfaces of the extremities or of the face, the skin which is most subjected to wear and tear being a favourite position, such as the extensor surfaces of the legs.

Sometimes the eruption is so extensive that there is not a hand's breadth of healthy skin upon the patient which does not show a granuloma.

When they appear on moist surfaces such as on the lips, under the nostrils, or around the anus, they slightly resemble the mucous patches of syphilis, and tend to last a long time or to fungate; also the characteristic crust, formed partly by the action of drying, is absent or modified. The scalp is not a common situation.

When they occur on the palmar surfaces of the hands or the plantar surfaces of the feet, in erupting through this horny layer they fissure the epidermis in all directions, and this is often accompanied by much pain. Healing in these situations is much slower than in other parts of the body; the horny layer of the soles of the feet often undergo complete desquamation and may leave chronic indolent sores.

Some of the nodules reach a very large size, and their crusts may stand out an inch or more from the surface; much of this has been formed by hyperkeratosis, which is occasionally a pronounced change in the older granulomata.

Again, a number of neighbouring elements may coalesce, and thus cover a large irregular area, or they may come together in the form of a circle and enclose a healthy islet of skin.

Secondary organisms convert some of the nodules into ulcers, this occurs in about 10 per cent. of cases. It is more likely to happen in debilitated subjects or those who have scratched, irritated or improperly treated the eruption.

In some cases the eruption breaks out again and again, thus causing the disease to last for a long time, even running on for years.

As the disease clears up it leaves hyperpigmented areas, or if there has been much ulceration there may be loss of pigment and a white scar results.

Yaws occurs among a class of people who usually harbour one or more variety of intestinal worms, and either *ascaris lumbricoides*, *trichocephalus trichiura*, *ankylostoma duodenale*, or *necator americanus* will be found present in practically all cases. Again, they will have been infected at one time or another with malaria. (I found in 21 blood smears the malarial parasite; this was out of 30 cases of yaws examined for this purpose.) Consequently, symptoms arising at any period of the disease cannot always be ascribed to yaws.

In many cases, as the granulomata appear there are very few constitutional symptoms, and the patient will not even cease work; but the majority have a low intermittent fever, with general malaise, numerous pains in the joints and limbs, a few enlarged hard lymphatic glands, and perhaps abdominal derangement such as diarrhœa.

Neuralgic pains are frequently complained of, and are probably the result of a mild neuritis.

Marked hyperidrosis is occasionally seen.

An acute arthritis has been described.

Periostitis in one or other bones arises in some patients. The most noticeable situations are where the bones come near the surface and are not covered by much muscular or subcutaneous tissue. Thus the front of the shin-bone, the ribs, the supraorbital ridges, the fingers, and the radius and ulnar near the wrist are common situations.

Blood examination shows a slight reduction in the number of red corpuscles and the hæmoglobin index. The leucocytes may show a small increase: the eosinophiles, the transitional and large mononuclear lymphocytes are increased, especially the first, but this is a usual condition in patients of this class, and depends upon the presence of intestinal and other parasites.

Tertiary Stage.—As already stated, this is a very arbitrary division; it is the result of chronic recurring eruptions of the secondary stage being accompanied by much ulceration due to secondary organisms. There is also periostitis and definite changes taking place in the growing area between the shaft and the epiphyses of the long bones in children.

The granulomata tend to appear in areas where the skin has already been weakened by injury or disease, and each recurrence of the eruption will be more liable than the last to ulceration as the resistance of the tissues becomes less and less. Extensive ulceration of the superficial structures of the limbs soon implicates the deeper structures and the muscles and periosteum undergo considerable changes, and nodules of chronic inflammatory material may appear in connection with them.

These changes are most liable to take place in children, especially those who have been badly fed and cared for. The junction of the epiphyses with the shafts of the long bones is the site of slow chronic changes; this gives rise to exaggerated growth, the bone lengthens and the diameter of that part which has grown under

diseased conditions is increased. The result is that the arms of patients appear long, coarse and bony, and the legs assume a stilt-like appearance.

Often there is a definite bowing forward of the tibiœ due to periostitis on the front of the bone or because softening has taken place. The antero-posterior diameter of the leg between the calf and the ankle is greatly increased, the wrists lose their shape and become thickened.

I have been able to pick out people who have suffered from yaws when children solely by these bone changes. The changes, though not so marked, may be seen in children who have never reached the tertiary stage.

Advanced cases in the tertiary stage present a truly repulsive and awful picture. The extremities have lost all shape, the skin has become a mass of scar and inflammatory tissue, and in one place is deeply pitted with varying sized hollows, and in another heaped up into nodules. In many places the scar tissue is adherent to the bone.

There are nodules of inflammatory tissue in the contracted and wasted muscles. The patient becomes a hopeless cripple and may remain in the hospital for years.

Fortunately, this miserable condition occurs in less than 1 per cent. of cases, but one or more patients can often be seen in this state at the Yaws Asylum.

Secondary Organisms.—Those most commonly present in the ulcers are :—

(1) The symbiotic spirochætæ and fusiform bacilli.
The organisms may be of very low virulence, but sometimes their virulence is greatly exalted, when they cause acute painful ulceration, sometimes proceeding to sloughing and phagedenic processes.

(2) *Staphylococci pyogenes, v. aureus, v. albus,* and *v. flavus.* The virulence of these is also very variable.

(3) Very numerous saprophytic or mildly pathogenic cocci and bacilli, and a variety of fungi and yeasts.

(4) I have isolated bacillus pyocyoneus, and members of the colon group, also a short chain streptococci.

Duration of the Disease.—In 10 per cent. of cases ulceration prolongs the course of the disease. When this is absent the patients average about four months in hospital (*vide* Chart D), and, as they are never isolated during the primary stage, the average duration of the disease can be reckoned as six to seven months.

Recurrences may prolong a case for a year or more; a single eruption has been known to last for 18 months.

It has been stated that the disease lasts longer in adults than in children. The statistics of this Yaws Asylum do not support this. (*Vide* Chart D.)

In my opinion, on account of the greater liability to ulceration and to changes in the growing bones, the disease is more serious in children than in adults. The latter rarely, if ever, lapse into that condition I have described under the tertiary stage.

The statistics of the Yaws Asylum show 7 per cent. re-admissions for recurrences.

Diagnosis.—The early manifestations of yaws are not easily recognised, nor do patients come under observation before the appearance of the granulomata of the secondary stage.

The papular eruption might be diagnosed by the small yellow adherent crusts, and the loss of gloss and rough appearance of the skin. These would direct the attention to a search for a primary sore.

The appearances of the granulomata are so typical that they are not likely to be confused with any other disease.

It is stated that it has been confused with *Verruga peruviana,* but this disease is limited to certain elevated valleys of the Andes. It is a more severe disease, being accompanied by high fever and has a large death rate.

The eruption has a different appearance, and may break out extensively on mucous membranes, as in the mouth. The evidence seems to indicate that it is a disease caused by a low protozoal organism, which is carried from the diseased to some skin lesion on the unaffected by the agency of some definite local factor.

Syphilitic eruptions never exactly resemble the nodular eruption of yaws. Even the few observers who once confounded the two diseases admitted that yaws was syphilis modified by racial and local factors.

It has become almost redundant to point out the following differences in the two diseases :—

(1) Immunity to the one does not confer immunity to the other.

(2) Localities in which the one is absent the other is rampant. Thus in Fiji and Samoa yaws was prevalent whilst syphilis was absent.

Syphilis is far more common in towns. Yaws is essentially a disease of the country and rural districts. (*Vide* Chart B.)

(3) The initial sore is usually genital in syphilis, rarely so in yaws.

(4) The analysis of microscopical sections of the eruptions in the diseases shows marked differences.

(5) Children are more liable to yaws, adults to syphilis.

(6) The secondary rash, alopecia, infection of the fœtus, changes in the permanent teeth, the ulcerating throat, the polymorphism of the tertiary eruptions, the retinitis, arteritis, and gummata so characteristic of syphilis are absent in yaws.

Two points the diseases have in common—they react to the same arsenical remedies, mercury and iodides, and both give the Wasserman blood reaction.

It may be noted that mercury and iodides have less effect upon yaws than on syphilis.

Prognosis and the effect of Yaws.—The prognosis in yaws is extremely good for the primary and secondary stages of the disease; deaths are extremely rare. In 7,157 cases collected by Dr. Nicholls, of Dominica, there were 185 deaths, or 25·8 per thousand.

In three years there were treated in the Ceylon hospitals 10,091 cases with only 49 deaths, which is less than five per thousand, a lower mortality than ever exists in the general population of a country.

In 2,200 cases admitted to the asylum of this island between the years 1882 and 1910 there were 67 deaths, which gives a death-rate of approximately thirty per thousand. This would only be a little greater than the death-rate of the general population during this period.

When a case ends fatally it is due either to septic and phagedenic processes supervening on the eruption, or from some intercurrent affection, such as malaria, bronchitis, or pneumonia.

The importance of the disease is, therefore, not in its mortality, but because it renders numbers of agricultural labourers and their children physically unfit for months or even years.

The limbs of those who have suffered from the disease have lost much of their strength and resistance, the slightest injury is liable to become an indolent ulcer, and fresh ulcers being produced year after year will, in some cases, render the sufferer a permanent cripple, and even necessitate amputation. The ultimate results of yaws have been overlooked by many writers, and the greater or less permanent injury to the limbs which occurs in quite a number of cases has not been fully appreciated.

No doubt if the patients were able to fully cloth their limbs, and thus protect them from the elements of the " bush " and jungle, this secondary trouble would not occur.

Those patients who reach the tertiary stage are wrecked in health and constitution, and their span of life will rarely exceed two or three years.

There is another side to this question; the effect of the disease upon the patient morally and mentally, and upon the locality in which they reside.

Long periods of isolation and idleness in a condition of physical unfitness, and not always among the most desirable companions, are likely to produce detrimental effects upon the moral and physical activities of children and young adults, by causing the acquisition of undesirable habits. The more cleanly and better class inhabitants will ostracise the sufferers of this loathsome and disfiguring disease, and avoid the localities from which they come. This will induce a loss of self-respect, which is a desirable asset even in the lowest walks of life.

Treatment.—Before commencing an active treatment directed to the destruction of the causal organism of the disease, the patients must be carefully examined for malaria and intestinal parasites, and by employing quinine, vermifuges, and high feeding the general health of the patient will be improved.

Where the asylum is on the sea-shore all patients should be induced to commence immediately a course of bathing. Otherwise carbolic or other disinfecting baths should be employed.

Before the advent of the arsenical remedies, it was usual to employ some preparation or other of mercury and iodides in the treatment of all patients; whatever may be the final opinion of such remedies as atoxyl and " salvarsan " in the treatment of syphilis, there can be only one as concerns yaws, which is, that they are far more efficacious than mercury.

The extraordinary drug " salvarsan " is of far more value than atoxyl, and in the treatment of yaws I have never seen untoward symptoms arise, whereas this has not always been the case with atoxyl.

I have injected it intramuscularly and subcutaneously into patients from the age of three and a-half years, and in all cases the eruptions have cleared up in a very short time. I have employed the intravenous method, but unless it is shown to be far more efficacious than the others, its extensive use is hardly justifiable.

Only two patients in twenty-five that I have injected have complained of much pain. No abscesses or other local conditions have arisen at the site of inoculation. In all cases an absolutely neutral suspension was employed. I have injected a few patients in huts and barracks.

The following list of twenty consecutive cases shows the ages of the patients, the amount injected, the method of inoculation, and the result. All subcutaneous injections were between the shoulder blades, and all intramuscular into the gluteal muscles. In five cases the Wasserman reaction was tested. All the patients of this list exhibited granulomata :—

—	Sex.	Age.	Amount of " Salvarsan."	Method.	Result.	Wasserman Reaction.	
						Before Injection.	24 days after Injection.
		Yrs.	Gms.				
1	Male ...	6	·2	Intramuscularly	Cleared up in 2 weeks		
2	" ...	12	·3	"	" " 2 "		
3	" ..	5	·2	"	" " 2 "		
4	" ...	30	·51	"	" " 4 "		
5	" ...	3½	·14	"	" " 2 "		
6	Female	13	·3	Subcutaneously	" " 2 "		
7	"	15	·3	"	" " 3 "		
8	"	4	·2	"	" " 2 "		
9	Male ...	16	·43	Intramuscularly	" " 2 "		
10	" ..	16	·42	Subcutaneously	" " 10 days		
11	" ...	7	·2	Intramuscularly	" " 3 weeks		
12	Female	40	·6	Subcutaneously	" " 3 "		
13	"	12	·42	Intramuscularly	" " 6 "		
14	"	8	·3	Subcutaneously	" " 12 days		
15	Male ...	21	·6	Intramuscularly	" " 10 "		
16	" ...	26	·6	"	" " 2 weeks	+	—
17	Female	22	·5	Subcutaneously	" " 12 days	+	—
18	Male ...	8	·28	"	" " 2 weeks	+	—
19	Female	18	·4	Intramuscularly	" " 4 "	+	∓
20	Male ...	5	·2	"	" " 2 "	+	—

In column six by " cleared up " is meant that all the eruption had disappeared and the skin had completely healed. In four other cases, in which over a year before the patient had had an attack of yaws, yet nothing but extensive ulceration of the shins remained, I gave injections of " salvarsan; " the ulcers quickly healed up, in far shorter time than would be expected from any other treatment. This suggests that continued ulcerative processes may be partly due to the specific organism of yaws and not entirely caused by secondary organisms.

The above chart indicates an almost ideal form of treatment, in which a blood test will conclusively demonstrate whether or not the disease is cured. Before the true value of the " salvarsan " treatment combined with the Wasserman reaction can be definitely settled, it must be tested upon a large number of cases, and the patients watched over a period of at least twelve months for recurrences.

In all cases whether or not the " salvarsan " treatment is employed some attention must be paid to the skin to prevent ulceration and to keep away flies. Treatment with caustics such as strong mineral acids is not desirable, as they are not likely to affect the course of the eruption, and there is greater tendency for the granulomata to ulcerate after their employment.

The sores should be washed each day in a mercury or other disinfecting lotion, and an ointment or dusting powder applied. The best ointment is one containing five per cent. of *Hydrargyrum ammoniatum* and ten per cent. of eucalyptol; the latter drug keeps away flies. A good dusting powder, for the first signs of ulceration, is one containing ten per cent. of calomel in equal parts of bismuth carbonate and zinc oxide. Phagedenic processes must be treated with pure carbolic acid or the acid nitrate of mercury.

Prophylaxis.—Involved in researches and diverted by laboratory studies one is apt to forget that the prevention and not the cure of a disease is the ultimate ideal. Consequently it is important to recognise many commonplaces and minor effects which in their totals may represent the lines along which certain diseases will be suppressed.

The public too generally look upon many diseases as evils which always have been and are unavoidable by certain classes. Many in the upper ranks of life view certain ailments of the lower class natives of the colonies as necessary accompaniments of their mode of life and of the climate.

The study of yaws has proceeded to that stage where a careful review of all the gathered factors should enable a concerted plan of action to result in the extirpation, in many parts of the world, of this disfiguring malady.

Among the less civilised natives in Africa and other places where they have little or no association with the white man, obviously nothing can be carried out for many years, but in islands such as this, on plantations and localities directly under the control of colonists, it is time that a more strenuous campaign were carried out, and it can only be done by the mutual combination of the Government authorities, the medical officers, the planters, and their overseers. The hesitancy of the first must be ascribed to their being loath to take an initiative in a matter where there are few precedents and little to guide them: the second must exhibit much keenness and energy: the planters and their overseers, although they may revile a loathsome disease which is playing havoc with their labourers, will probably say that it is impossible to do anything for them, they are ignorant, they are suspicious, you are seeking their welfare, but they do not appreciate it, and anything which is tried will be thrown away upon them.

This outlook has probably arisen from the reason that they have found that the labourers are naturally not expending all their energy for their employers' welfare, and that they are careful never to do more for their pay than is absolutely necessary; besides, they probably view all new efforts on the part of the overseers as possible attempts to impose upon them.

Personally I have found that in matters of health the native is quick to appreciate what is best for him. I have been told that the negro will not take quinine. This, I think, has been amply disproved, for the majority of them, by the large amount of quinine which is now distributed to them at their request. Every day I have requests from coloured labourers for this drug. Some of them, having had experience with it, look upon it as a necessity.

Also I have heard it stated by those who should be well acquainted with negroes, that they much prefer their dirty rags and " mash " of leaves upon their ulcers to proper clean dispensary dressings of lint and bandages; this again is incorrect, the truth is that either not knowing correct dressings or being unable to provide themselves with them, they must resort to some protection and ignorant treatment for their sores and wounds. On my dispensary day at Cul-de-Sac, during the time of the year when ulcers are common, it is a frequent sight to see numerous labourers waiting to request lint and disinfecting lotion or ointment for their minor afflictions. On several occasions negroes have told me that flies carry yaws and are bad upon their wounds and they make efforts to keep them off. I have had cases in which a family have left one district and gone into another because they were infected with framboesia, and their neighbours objected to them, or where labourers have been the first to notice and request the transportation of a patient to the yaws asylum. Surely these facts indicate some co-operation even from the lowest classes.

I have shown that yaws occurs well nigh exclusively in agricultural districts, and that it depends upon three factors:—

A.—(1) Nakedness.
(2) Liability to small injuries and abrasions.
(3) The presence of the ulcer fly and perhaps " musca domestica."

It will be with due consideration of these that part of the efforts for the prevention of the disease will be made, and secondly with the infected:—

B.—(1) The strict isolation of all cases which arise.
(2) The thorough treatment of these cases.
(3) The careful watching of all cases which are discharged as cured.
(4) The look-out for " chronic carriers."
(5) The disinfection of clothes and dwellings.

The first three headings (A 1, 2 and 3) suggest at the present time but one practical scheme, namely, freely supplying dressings, disinfectants, and ointments for the protection and treatment of injuries and to keep away flies and possibly other insects. Where it is possible to persuade labourers to use more clothing, and above all to supply light apparel to their children, this should be attempted.

As concerns the reduction of flies this is a difficult question where pastures are numerous and much pen manure is required for agricultural purposes.

To the question who is to supply the dressings, &c., the answer depends upon the circumstances; in most instances it will be with the Government, but in some cases the owners of estates might be persuaded to do this.

The requisites would be lint, bandages, " cyllin " disinfectant (on account of cheapness), and an ointment, preferably one containing eucalyptol. The cost of distributing these for the use of labourers only would, in an island such as this, be less than £100 per annum.

It is not sufficient to vote a small sum of money and supply dressings to a responsible person in each locality, for in some cases these will be placed upon a shelf and almost forgotten. The dressings must be doled out at suitable situations on all estates and in villages, and agricultural overseers must be asked to thoroughly acquaint the labourers with the fact, and when they see abrasions or ulcers which are not covered they must see that the labourer properly attends to them. I am certain that where the efforts of the planter are properly solicited and a mild but adequate control is kept of the dressings, the results will not be disappointing.

Perhaps exposed ulcers might be made an offence, where there is no excuse for these being undressed on account of a free supply of dressings.

Persons with ulcerated legs and arms, with perhaps a few dirty soaked rags covering them, are a frequent and repulsive sight in the tropics, and there may be some connection between these and numerous skin conditions, and even such a disease as leprosy.

The next five headings (B 1, 2, 3, 4, and 5) call for the energetic action of all concerned—the Government, the planters, and the medical officers, as well as something from the afflicted class, the labourers.

1. The Government should draw up stringent regulations to provide for the isolation of all cases of yaws. In these islands and in many other parts of the world regulations are in force, but they are often of an inadequate nature and are improperly carried out. Difficulties undoubtedly arise, as in the case of an outbreak in a family who wish to avoid isolation and betake themselves to some less controlled district or to a less accessible locality. On the majority of these occasions, careful watching and prompt action on the part of the authorities will prevent this.

Government regulations should leave no loophole, such as exists in this island, where a clause states that if the Medical Officer considers that the disease can be properly treated at home and is not a danger the patient concerned need not be isolated. All health regulations must be framed upon orthodox knowledge and opinions which are held by all the leading authorities upon the subject, and these cannot take into consideration occasional and heretical views which may here and there arise in would-be original individuals. There may still exist a few medical men who consider that yaws and syphilis are the same disease, and these, unless some ingenious method of argument were employed, could confound all the present existing rules and prevent those of the future which did not take into consideration their stray opinions.

2. The thorough treatment of all cases by the Erlich-Hata arsenical remedy " Salvarsan," if future experience continues to uphold the present promise, and this is almost certain, and the protection of the skin eruptions by dressings and ointments.

If this treatment is carried out, it is obvious that each patient will for a shorter period of time be liable to infect others. Again, an analysis of cases shows that the number of recurrences is large, probably larger than can be shown by figures, for many patients attempt to avoid again losing their liberty by isolation. So that the more radically a patient is cured the less likely is he to be a menace to his associates

upon his discharge. The Wasserman reaction may be an absolute test as to whether the patient is or is not cured.

3. Every patient who is discharged should be induced to present himself at the nearest dispensary at definite intervals to be examined by a medical man, who, on the first appearance of a recurrence, will send him back to the asylum for further treatment.

This must be brought about by a definite and well-ordered plan, for difficulty may arise in compelling patients to appear for examination. They must be made to do this, but not gratuitously. I believe the following scheme would act well in practice in these parts of the world:—

> Each patient (if under 12 years of age, his or her guardian) upon being discharged is given a paper on which are a certain number of dates upon which days he must present himself at the nearest dispensary, and he will receive a shilling for doing this. A similar paper is forwarded to the district medical officer, and upon examining the patient he will place his initials opposite each date. In the event of a patient failing to appear the medical officer will acquaint by writing the police, who will immediately compel the patient to attend, and in this case he naturally forfeits the shilling.

It will be advisable to cause patients to attend once every month for the first six months, once every two months for the next twelve months, and then for two years at intervals of six months. The cost of this can be estimated at £45 per annum for each 100 patients.

This certainly cannot be considered excessive for watching this number of possible infectors of others; besides there will be formed records of the greatest scientific value in throwing light upon a number of points which are obscure and which will be of great value to students of this disease.

4. Many outbreaks of yaws arising in collections of huts or barracks in agricultural districts can be traced to the presence of a " chronic carrier."

Two classes of patients fall under this term. The first includes those who have much resistance to the disease, causing it to be latent and giving rise at the most to a feeling of malaise and the eruption of numerous papules none of which reaches the granulomatous stage, but a few may form small infective ulcers. On two occasions where outbreaks had occurred, I have been able to discover what I believed to be mild cases, to keep them under observation, and, finally, upon the patients showing more definite signs, to have them isolated.

The second class includes cases which have had a well-marked attack, but continually have, perhaps for years, insidious recurrences.

5. It is important that all the clothing which the patient has worn since the acquisition of the disease should be removed and disinfected, for it is possible that another person might be infected by wearing these clothes.

It would require little work to clean out and disinfect the patients' dwellings. This could be done in the manner which is employed in cases of pneumonia at the present time : A constable sees that the clothes and bed coverings are placed in a solution of " cyllin " and the room sprayed with a similar solution.

As has been stated previously, the co-operation of the planters and their overseers is essential, and this should be obtained by giving them the least possible trouble and by satisfying their enquiries and suggestions.

Planters often form the opinion that a certain locality is very unhealthy and harbours many cases of yaws; if they report this and are not acquainted with what is carried out or it is found that they have formed mistaken views and these are not explained to them, they will naturally feel that their suggestions have not been attended to, or that the authorities are insufficiently alive in the matter. More satisfaction might be given by a system of circulars and reports; the former would explain what was required and request that the overseers are asked to keep an outlook for cases of yaws, and upon these appearing the planter would attempt to send these to the medical officer, or send off a supplied and printed post card stating that there were supposed cases of the disease in such and such a locality. The medical officer, accompanied by a constable or inspector of nuisances, would visit the places indicated and conduct a careful examination for cases. Finally, the medical officer should acquaint the planter with the result of his examination.

It is only by systematic efforts of this kind that the disease is likely to be exterminated from agricultural districts, and these should replace the procedures of the present time, which are often of a desultory nature.

The Government now spends from £8 to £10 on each patient who is isolated; if the total sum were increased for a few years, there would soon be few patients

to isolate; thus there would be not only a gain in health to the community, but also a progressive lessening of the sum spent upon the isolation of the sufferers.

LUCIUS NICHOLLS.

16 October, 1911.

A 1.

Year.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	Totals.	Percentage of total.
Males	35	73	62	104	109	77	131	50	38	32	30	30	28	17	46	38	49	30	48	20	45	26	35	37	37	52	66	50	55	1,444	
Females	30	55	40	57	55	61	105	38	28	14	25	11	18	19	24	30	27	14	33	11	24	13	25	25	16	35	32	15	29	909	
																														2,353	
Percentages of Males ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		61·3
Percentages of Females	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		38·6

Percentage liability to yaws for sex:—

Males ... ... 66 per cent.

Females ... ... 34 ,,

A 2.

Age.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	—	I.	II.
1—5 years	18	36	25	28	35	26	52	14	16	8	16	7	14	5	14	9	10	4	23	8	10	7	11	9	6	10	13	9	3	446	19·31	43·63
6—10 years	18	22	25	42	46	33	59	26	10	7	3	11	6	6	16	15	16	9	19	7	18	10	10	19	9	30	36	15	19	562	24·32	
11—15 years	14	13	16	34	18	13	30	14	8	6	7	6	2	4	9	9	12	13	10	3	17	7	10	9	16	13	20	16	28	377	16·32	26·14
16—20 years	5	19	7	19	8	18	21	10	3	5	5	3	7	6	7	2	5	4	5	5	3	3	10	4	10	9	6	7	11	227	9·82	
21—25 years	2	12	8	8	10	8	10	3	2	..	2	2	2	4	6	10	7	3	7	1	2	2	1	5	2	4	3	7	3	136	5·88	12·93
26—30 years	3	4	8	14	10	7	16	5	3	6	9	5	7	6	3	5	9	1	3	1	6	4	8	1	2	5	4	2	6	163	7·05	
31—35 years	1	4	2	2	3	7	13	3	3	..	..	..	2	1	1	3	9	5	2	1	5	2	1	6	..	4	4	1	1	86	3·72	11·51
36—40 years	2	10	8	11	9	13	25	9	15	8	10	3	3	2	2	3	6	2	6	1	5	2	5	3	5	4	4	2	2	180	7·79	
41—45 years	2	2	6	1	2	6	7	4	3	..	..	..	..	2	1	3	1	0	2	1	1	1	..	..	..	1	..	2	2	50	2·20	4·53
46—50 years	1	5	3	2	4	1	7	2	1	3	1	3	..	..	2	1	1	2	3	..	2	1	3	2	1	..	1	..	2	54	2·33	
51—55 years	..	..	3	1	1	..	1	..	..	..	..	..	..	..	..	1	..	..	..	2	..	..	..	1	..	..	..	2	..	12	·51	1·16
56—60 years	..	1	..	..	..	2	2	1	2	..	..	..	2	1	..	..	1	..	..	1	2	..	..	..	..	..	..	..	..	15	·65	
61—65 years	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
66—70 years	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..
Total cases analysed																														2,310		

Column I. shows percentages for each five years of life.
Column II. shows percentages for each decade of life.

A 3.

Ages.	Males.	Females.	Total.	Percentages of total population for each decade.	Percentages of total Yaws cases.	Percentage liability to Yaws for each decade.
1—10	7,387	6,997	14,384	33·1	43·63	27·6
10—20	4,527	5,113	9,640	22·2	26·14	21·6
20—30	3,765	4,566	8,331	19·2	12·93	14·2
30—40	2,423	2,724	5,147	11·8	11·51	20·4
40—50	1,622	1,918	3,540	8·1	4·53	11·4
50—60	1,115	1,201	2,316	5·3	1·16	4·4
Totals	20,839	22,519	43,358	99·7	99·9	99·6

Explanation of Charts.

A 1 shows that persons admitted to the Yaws Asylum suffering from the disease between the years 1882 and 1910 were 61·3 per cent. males and 38·6 per cent. females.

As the average population in the island during this time was 20,839 males to 22,519 females, the percentage of liability to yaws is for males 66 per cent., for females 34 per cent.

(A slight mathematical error occurs here, as between the ages 1-10, there are more males than females, at the other ages females preponderate; as more cases of yaws occur between ages 1-10, this should have been allowed for.)

A 2 shows the number of cases which occurred for each five years of life.

Column I. gives the percentages for each five years.

Column II. gives the percentages for each ten years.

Possible errors may creep in in dealing with primitive people, whose ages are unknown to themselves. But these are almost negligible, as those who admit patients to the asylum would, on the average, place them in the correct decade of life.

A 3. As there is a preponderance of the population during the earlier ages of life, Chart A3 is drawn up to show the population of males and females for each decade, their percentages of the total population, and by a comparison of these with the percentages of total yaws cases we arrive at the percentages of liability to yaws for each decade.

(An error may arise from the fact that a few patients are admitted to the asylum suffering from old yaws ulcers, and as, after 30, past patients are very liable to these outbreaks, this may account for the high figure for the ages between 30 and 40.)

N.B.—It will be noticed that the total 2,353 of Chart A1 is greater than the total 2,310 of Chart A2; the reason of this is that the records failed in a few cases to state the ages of the patients.

B.

—	Number of cases for each locality, estate, &c.	Total for each district.	Average population, 1883–1910.	Number of population per case for 28 years.	Number of population per case per year.	Per cent. of total cases for each district.	Area in square miles.
Castries Town :—							
Sent in from dispensaries ...	76	76	7,299	1 in 96	1 in 2688	3·4	·16
Castries Rural district :—							
Crown lands (Barracks) ...	74						
Soucis (Barracks)	50	284	9,054	1 in 31·8	1 in 890	12·8	34·86
Other estates and country places	160						
Anse la Raye district :—							
Sent in from dispensary ...	69						
Rosseau estates (Barracks) ...	271						
Anse Laverdure	25						
Anse Gallet	26	518	2,507	1 in 4·8	1 in 134	23·4	24·05
Canaries village and neighbourhood.	64						
Other country places and estates	63						
Soufrière district :—							
Sent in from dispensary ...	182	394	5,851	1 in 14·8	1 in 414	17·8	22·89
Estates and country places ...	212						
Choiseul district :—							
Sent in from dispensary ...	53	103	4,322	1 in 41·9	1 in 1173	4·6	9·47
Estates and country places ...	50						
Laborie district :—							
Sent in from dispensary ...	127	138	3,288	1 in 23·8	1 in 666	6·2	12·61
Estates and country places ...	11						
Vieux Fort district :—							
Sent in from dispensary ...	156						
Ressouce	63	287	3,471	1 in 12	1 in 336	13·0	18·41
Estates and country places ...	68						
Dennery district :—							
Sent in from dispensary ...	66						
Mabourya Valley	75	219	3,728	1 in 17	1 in 476	9·9	27·97
La Caye	30						
Other estates and country places	48						
Micoud district :—							
Sent in from dispensary ...	52	60	2,628	1 in 43·8	1 in 1226	2·8	41·04
Estates and country places ...	8						
Gros Ilet district :—							
Sent in from dispensary ...	29						
Marquis estate	55	127	3,869	1 in 30·4	1 in 851	5·7	41·83
Dauphin	33						
Estates and country places ...	10						
	2,206	2,206	46,017	1 in 20·8	1 in 582	99·6	233·29

Summary of Chart B:—

Town of Castries:—

			Per cent. of total.	
(1) Sent in from dispensaries	76	...	3·4	
Country:—				
(2) Sent in from dispensaries at villages ...	734	...	33·2	96·4 per cent. for country.
(3) Estates' barracks and huts, &c. ...	1,396	..	63·2	
	2,206			

Explanation of Chart B:—

The chart exhibits the number of cases which the records show to have been admitted from the town of Castries and the nine rural or village districts.

Unfortunately the register has not been very precise in this matter and does not always state whether the cases occurred in the villages or on the surrounding estates or localities. I have therefore included all cases in which the name only of the village is given under the heading " sent in from dispensary."

It will be noticed how the cases preponderate in the barracks and huts of the large alluvial valleys attached to the four sugar factories:—thus, Rosseau, 271, Cul-de-Sac factory estates (Crown lands and Soucis), 124, and the majority of the cases from Vieux Fort and Dennery districts.

Anse la Raye district, including Rosseau, easily heads the list, and is followed by Vieux Fort and Soufrière.

The last column, showing the area in square miles for the town and districts, is of importance, as it shows the little connection which exists between yaws and the density of the population.

The chart confirms the experience that yaws is practically absent from Castries, which was recently a garrison town and possesses a large coaling port, and where syphilis is consequently rampant.

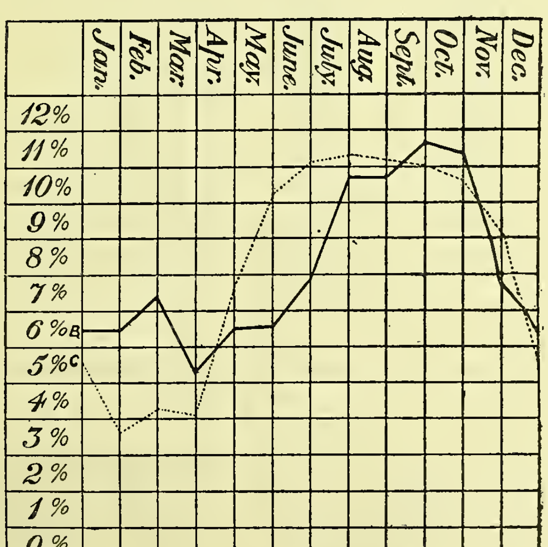
C 1.

—	1883.	1884.	1885	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	Total.	Percentage of total.
January ..	11	1	12	21	1	17	13	1	..	1	3	2	1	11	2	8	1	5	3	..	3	3	1	1	4	5	7	1	139	6·5
February ..	9	14	4	8	2	13	20	9	1	..	..	4	2	1	11	2	4	6	1	..	..	2	1	2	6	3	5	8	138	6·5
March ..	14	5	25	7	3	12	13	4	1	4	2	5	1	2	4	1	4	3	1	2	3	13	1	2	5	7	6	7	157	7 4
April	5	8	8	11	5	14	8	1	3	2	1	2	2	1	..	1	1	6	1	9	4	4	3	2	2	5	1	1	111	5·3
May	6	11	10	22	12	11	7	..	2	3	4	..	4	9	2	4	..	5	1	1	2	1	5	2	6	3	3	5	141	6·6
June	3	3	22	18	10	19	4	7	4	10	2	3	..	..	3	11	2	2	..	2	2	2	5	3	3	5	3	4	142	6·7
July	7	4	14	8	14	13	3	7	6	3	3	4	1	3	..	9	5	7	5	13	6	4	6	4	3	7	1	9	169	7·9
August ..	20	10	14	3	15	13	2	6	8	8	4	5	5	13	7	4	4	10	5	8	2	4	9	5	8	15	3	19	229	10·8
September ..	20	18	10	13	14	27	1	8	3	5	6	1	5	5	7	8	6	9	..	6	4	5	7	4	10	13	6	6	227	10·7
October ..	14	10	12	12	33	33	1	5	8	6	7	5	5	4	6	10	1	3	4	13	5	4	7	8	7	14	6	7	250	11·7
November ..	7	7	13	23	13	39	3	6	3	4	2	9	7	4	12	5	10	8	4	8	4	4	5	11	18	4	5	4	242	11·4
December ..	4	6	11	15	7	8	2	6	1	6	4	1	2	9	7	5	2	6	3	4	2	6	4	3	10	13	12	7	166	7·8
Totals ..	120	97	155	161	129	219	77	60	40	52	38	41	35	62	61	68	40	70	28	66	37	52	54	47	82	94	58	78	2,121	—

C 2.

—	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	Average for 19 years.	Percentage of total.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	
January ..	10·6	3·9	7·3	4·5	6·0	11·1	5·5	3·8	4·6	6·4	2·4	4·6	2·5	4·0	8·5	2·9	3·3	3.6	2·2	5·18	5·6
February ..	4·8	5·0	2·6	6·4	4·1	2·0	2·9	4·4	3·0	3·5	2·9	1·0	1·4	4·2	4·8	1·7	1·9	2·4	2·5	3·28	3·5
March.. ..	3·8	1·2	5·0	3·1	5·8	6·4	6·8	5·8	4·4	5·1	3·1	2·1	2·4	3·3	3·5	5·3	2·4	2·9	2·5	3·98	4·3
April	4·2	1·9	4·0	9·6	2·8	4·3	13·0	1·8	5·2	1·3	2·8	1·0	1·9	3·3	2·0	3·0	2·0	2·2	5·7	3·82	4·1
May	4·0	4·3	14·8	9·0	2·7	14·5	12·0	18·9	2·4	1·3	7·3	4·7	9·2	2·3	6·3	5·2	5·1	4·2	3·8	6·98	7·6
June	6·5	6·2	20·1	10·6	7·7	4·6	14·3	8·9	6·7	8·7	6·2	9·2	2·3	6·3	5·2	5·1	4·2	8·7	5·8	9·39	10·2
July	5·6	9·1	11·1	18·5	5·7	7·7	10·9	12·7	13·0	7·3	8·0	16·4	9·3	13·2	8·3	9·0	9·8	8·5	10·5	10·28	11·2
August ..	10·1	9·7	6·1	12·8	5·4	10·4	7·9	13·6	13·2	17·3	13·2	9·5	12·3	10·8	9·1	10·0	13·5	6·0	5·5	10·38	11·3
September ..	5·2	4·2	13·1	11·9	7·1	17·2	7·1	6·9	25·2	8·6	7·1	21·2	9·6	6·1	8·3	8·3	9·3	8·6	8·9	10·24	11·2
October ..	12·0	9·4	10·6	8·4	21·0	13·2	4·8	12·2	10·9	7·0	9·8	3·9	7·8	12·3	9·8	8·0	11·5	8·2	9·7	10·08	11·
November ..	7·3	11·0	8·3	11·4	7·8	17·3	17·4	11·4	12·2	11·8	6·8	7·9	12·7	6·2	6·1	9·7	8·5	7·8	4·8	9·84	10·7
December ..	12·5	3·7	6·1	6·8	4·8	12·1	10·9	10·3	6·1	5·9	3·1	11·5	9·3	16·4	3·9	3·9	5·1	7·7	17·5	8·34	9·1
Total rainfall each year.	88·11	70·15	109·67	113·60	81·55	121·29	113·93	111·26	107·49	84·64	73·25	99·71	91·43	86·84	77·72	72·64	81·84	71·33	79·98	91·39	—

C 3.



Explanation of Chart C 1, 2 *and* 3 :—

These charts, which appeared in a previous report, have been carefully revised and a few minor errors corrected.

C 1 shows the number of patients who have been admitted to the Yaws Asylum each month, from January, 1883 to December, 1910.

It is noticeable how the number of cases increase from July to November.

C 2 shows the amount of rainfall, in inches, which has fallen each month, from January, 1890 to December, 1908, it indicates a wet season from June to December, with the earlier months comparatively dry.

The last column of this chart gives the percentages for each month.

C 3 compares the curves of percentages of yaws cases and rainfall.

It is noticeable that there is a marked increase of admissions taking place about two months after the rainfall. The explanation of this occurs elsewhere in this report.

The unbroken line starting at B = Yaws patients curve.

The dotted line starting at C = Rainfall curve.

D 1.

Remained in Isolation Hospital	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	Total.	Percentages.	Percentages of under and over 100 days.
Less than 100 days..	62	49	28	69	61	80	54	24	21	18	17	17	19	25	33	36	18	24	10	35	22	12	24	28	29	41	26	37	919	48·06	48·06
100-200 „ ..	45	31	15	13	38	30	52	7	11	12	13	10	10	17	4	17	8	17	13	16	11	5	12	8	16	29	20	22	502	26·25	
200-400 „ ..	7	12	10	21	21	21	47	10	13	2	12	8	4	8	6	7	8	7	23	8	6	2	7	3	7	7	13	8	308	16·10	51·94
Over 400 „ ..	6	10	8	4	10	11	24	19	9	3	8	5	1	1	..	7	3	4	3	2	2	1	12	5	2	1	7	15	183	9·59	
Total ..	120	102	61	107	130	142	177	60	54	35	50	40	34	51	43	67	37	52	49	61	41	20	55	44	54	78	66	82	1,912	99·98	

D 2.

—	Length of stay of all Patients admitted.						Excluding Patients who remained more than one year.					
	Aged over 20.		Aged 10-20.		Aged 1-10.		Aged over 20.		Aged 10-20.		Aged 1-10.	
	Total Number of days of stay.	Number of Patients.	Total Number of days of stay.	Number of Patients.	Total Number of days of stay.	Number of Patients.	Total Number of days of stay.	Number of Patients.	Total Number of days of stay.	Number of Patients.	Total Number of days of stay.	Number of Patients.
1883	2,743	27	3,000	33	6,032	54	2,743	27	3,000	33	5,632	53
1884	2,899	25	4,010	21	7,714	49	1,887	23	2,398	18	4,800	43
1885	2,147	13	4,054	19	5,059	26	676	10	2,927	18	2,799	22
1886	4,500	28	3,588	23	5,976	48	2,975	26	2,501	21	4,891	46
1887	5,213	37	4,100	29	10,976	61	3,373	34	2,515	26	8,368	56
1888	6,921	51	6,904	43	10,127	47	4,589	48	4,122	39	4,854	39
1889	8,024	48	7,575	42	20,598	84	5,711	44	5,474	38	9,664	75
1890	3,258	18	3,239	10	11,298	28	1,742	15	1,032	8	1,333	12
1891	3,360	20	1,010	10	8,571	22	2,107	17	1,010	10	2,389	14
1892	2,096	16	530	5	3,063	13	1,666	15	530	5	951	10
1893	2,333	14	2,259	13	7,550	22	1,463	12	1,709	12	3,137	17
1894	1,459	12	1,102	6	4,146	22	1,459	12	627	5	1,991	18
1895	1,221	13	1,243	10	1,695	9	1,221	13	1,243	10	1,244	8
1896	2,069	18	1,171	10	2,925	23	2,069	18	1,171	16	2,479	22
1897	767	10	1,985	18	1,359	15	767	10	1,985	18	1,359	15
1898	2,540	25	2,832	11	4,778	28	2,540	25	932	8	2,836	25
1899	1,421	12	2,608	15	1,720	9	1,421	12	1,729	13	1,302	8
1900	1,321	12	3,151	20	4,257	18	906	11	3,151	20	1,735	14
1901	1,571	9	2,388	10	6,523	28	1,571	9	1,435	8	5,460	26
1902	1,644	19	3,191	16	3,861	24	1,249	18	1,972	15	2,432	21
1903	1,099	7	1,525	13	3,663	24	1,099	7	1,525	13	2,205	21
1904	338	5	1,137	6	1,120	8	338	5	277	5	736	7
1905	2,712	10	4,066	18	4,717	24	1,367	7	2,008	16	1,233	17
1906	752	3	3,656	17	1,287	15	163	2	1,122	15	698	14
1907	1,416	10	2,751	15	2,488	24	1,416	10	1,862	14	1,929	23
1908	1,153	11	3,308	24	5,548	44	1,153	11	3,308	24	4,107	42
1909	4,945	13	3,714	26	4,451	22	1,633	10	3,223	25	2,673	19
1910	1,622	13	10,875	41	5,584	25	1,622	13	3,331	32	1,619	18
	71,544	499	90,972	524	157,086	816	50,926	464	58,119	485	84,856	705
Average ...	143		173		192		109		119		120	

D 2x.

Number of patients who remained in hospital for over one year:—

Those aged over 20 years ... ... 35 = 7 per cent. of total.

Those aged between 10-20 years ... 39 = 7·4 per cent. of total.

Those aged between 1-10 years ... 111 = 13·5 per cent. of total.

Explanation of Charts D 1 and D 2:—

D 1 shows the length of stay of all those patients admitted to the Yaws Asylum whose records were sufficiently accurately kept. It will be seen that 48·06 per cent. were in for less than 100 days.

D 2 is divided into two sections, the first section shows the length of stay of all patients, it is divided into three columns for the purpose of showing the relative length of stay of patients over 20 years of age, of patients between 10 and 20, and of patients between 1 and 10.

The second section shows the length of stay of only those patients who remained in the asylum for one year or less. This section was drawn up because certain patients who had remained in three to four or even more years, introduced too great an error into the averages.

Allowing that all patients come to the asylum at about the same stage of the disease on the average, and that none are discharged until they are considered cured, the tables indicate that there is a tendency for the disease to last longer in children than in adults.

D 2x shows that there is a greater tendency between the ages 1 and 10 for the disease to become chronic than at any other decade of life.

TROPICAL DISEASES RESEARCH FUND.

REPORT

OF THE

ADVISORY COMMITTEE FOR THE TROPICAL DISEASES RESEARCH FUND

for the Year 1912.

(*For Report for* 1911 *see* [*Cd.* 6024] *February*, 1912.)

Presented to both Houses of Parliament by Command of His Majesty.
March, 1913.

LONDON:
PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE.
To be purchased, either directly or through any Bookseller, from
WYMAN AND SONS, LIMITED, FETTER LANE, E.C., and 32, ABINGDON STREET, S.W.,
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T. FISHER UNWIN, LONDON, W.C.

PRINTED BY
DARLING AND SON, LTD., BACON STREET, E.
1913.

[Cd. 6669.] *Price* 2*s*. 3*d*.

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REPORT

OF THE

ADVISORY COMMITTEE

FOR THE

TROPICAL DISEASES RESEARCH FUND

For the Year 1912.

Report.

The Advisory Committee for the Tropical Diseases Research Fund was constituted by the Secretary of State for the Colonies in July, 1904. It is now composed as follows:—

The Right Honourable Sir J. West Ridgeway, G.C.B., G.C.M.G., K.C.S.I., P.C., LL.D. (Chairman);
Sir Thomas Barlow, Bart., M.D., K.C.V.O.;
Sir John Rose Bradford, M.D., D.Sc., K.C.M.G., F.R.S.;
Surgeon-General Sir A. M. Branfoot, K.C.I.E., I.M.S.;
Surgeon-General Sir David Bruce, C.B., F.R.S.;
Sir Patrick Manson, M.D., G.C.M.G., F.R.S.;
Mr. F. C. Drake;
Mr. H. J. Read, C.M.G.;
Major Sir Ronald Ross, K.C.B., F.R.S.;
Mr. J. A. C. Tilley.
Mr. A. Berriedale Keith, D.C.L. (Secretary).

Sir Thomas Holderness, who had been a representative of the India Office since 1904, resigned his membership on his appointment in October to be permanent Under-Secretary of State for India, and the Committee desire to express their appreciation of the services which he rendered and of the interest which he took in the work of the Committee.

The revenue of the Tropical Diseases Research Fund for the year 1912 was made up as follows:—

Contribution from the Imperial Government	£1,000
Contribution from the Government of India	500
Making a total of	£1,500

Contributions from Dominion and Colonial Governments in the following proportions:—

	£
Southern Nigeria	350
Gold Coast	200
Ceylon	100
Straits Settlements	100
Federated Malay States	100
Hong Kong	100
Trinidad	100
Jamaica	100
Fiji	100

	£
Sierra Leone	100
The Gambia	100
British Guiana	100
Zanzibar*	50
British Honduras	50
Grenada	50
Leeward Islands	25
St. Vincent	20
Making a total of	£1,745
In all a total of	£3,245

The expenditure of the year was made up as follows:—

	£	s.	d.
To the London School of Tropical Medicine	1,533	6	8
To the Liverpool School of Tropical Medicine ...	1,200	0	0
To the University of London	750	0	0
To the University of Cambridge	350	0	0
Making a total of	£3,833	6	8

The excess of expenditure over income was met, as in the previous year, by drawing on the accumulated balance of the Fund, and it was necessary to warn the Schools of Tropical Medicine that it would not be possible to repeat in 1913 grants on the same scale. In view of the many important questions relating to tropical diseases which call for further research, the Committee would again place on record the importance of an increase of the Fund now at their disposal.

Of the grant to the London School of Tropical Medicine (£1,533 6s. 8d.), £1,333 6s. 8d. was expended in respect of the salaries of a teacher and investigator of helminthology, a teacher and investigator of protozoology, and an arthropodologist, and expenditure in connection with the maintenance of their laboratories. An essential condition of the grant made to the School from the Fund is that these teachers should devote their spare time to research work. As in 1911 a sum of £200 was granted to the School in order to provide an assistant for the helminthologist, so as to relieve him of routine work and to enable him to concentrate his efforts on research.

Of the grant to the Liverpool School of Tropical Medicine (£1,200), the sum of £1,000 was expended partly in payment of the salaries of the lecturers in economic entomology and parasitology, partly in paying a proportion of the salaries of the workers in trypanosomiasis, and expenses connected with research into that subject. The sum of £200 was granted to defray the cost of employing a chemist.

The grant to the University of London (£750) was expended in paying the salary of the Professor of Protozoology, whose post was established in 1906 for a period of five years by means of a grant from the Fund, and whose tenure of office was extended for another five years from 1911 on the recommendation of the Advisory Committee.

Of the grant to the University of Cambridge (£350), £100 was paid in respect of the Research Studentship in Medical Entomology, established in 1907 by means of a grant from the Fund, while £100 was granted towards defraying the salary of an assistant in the Quick Laboratory; £50 for the salary of a Consulting Entomologist, and £100 towards the general expenses of the Quick Laboratory. The grant of the latter sum of £100 was considered by the Committee to be fully justified in view of the assistance which was rendered by that laboratory to workers in tropical diseases from the Colonies.

As in 1908 to 1911, it was not found necessary to make any grant to the Royal Society from the Fund as other provision has been made for the carrying out of the research with regard to sleeping sickness which is being carried on under the general supervision of the Society.

* Zanzibar also paid in 1912 an additional £100, representing grants in respect of 1910 and 1911.

The Committee were consulted on various matters during the year by the Secretary of State, including the question of the advisability of the use of salvarsan in the treatment of yaws in the tropical Colonies.

The Committee append to their report reports received from certain Colonies and Protectorates in accordance with the request contained in the Secretary of State's circular despatch of the 20th of December, 1910, which is printed in their report for 1910 [Cd. 5514], asking for the supply of statistical and other information with regard to mosquito-borne diseases. These reports embody a brief account of the anti-malarial measures taken in the different Colonies and Protectorate. The Committee desire to lay great stress on the importance of the regular supply of these reports, and of the need of continuing and developing anti-malarial measures in the tropical Colonies and Protectorates.

The Committee also append reports of the work done at the London and Liverpool Schools of Tropical Medicine for the year November, 1911, to October, 1912; the report of the Professor of Protozoology in the University of London for the session ended June, 1912; the report of Professor Nuttall on the work done by the research student in entomology at the University of Cambridge and in the Quick Laboratory, reports on the work done at various Colonial laboratories which have been sent in accordance with the request made by the Secretary of State for the Colonies in December, 1906, and a report on Vomiting Sickness in Jamaica by Captain Potter, R.A.M.C. The Committee regret that for various reasons the reports from the Colonial laboratories are not so numerous or so complete as in former years, but they are satisfied that excellent work is being carried on in these laboratories, and they trust that it may be found possible in future to increase the opportunities afforded for research work in the Colonies.

The report from the laboratory maintained by the Governments of the West African Dependencies at Yaba is not reprinted as it has been published by the Government of Southern Nigeria.

WEST RIDGEWAY.

A. Berriedale Keith,
Secretary.

7th March, 1913.

APPENDIX I.

Reports on Anti-Malarial Measures in the Crown Colonies and Protectorates, &c.

The following are the returns asked for in the Secretary of State's despatch of 20th December, 1910 :—

(Draft) Return of Malarial Fever, Blackwater Fever, Yellow Fever, Filariasis, and Dengue during the year from the 1st January to the 31st December (1910).

1. Name of Colony.
2. Total area.
3. Estimated population :—
   (*a*) Total.
   (*b*) Europeans.
   (*c*)
   (*d*) Other races.
   (*e*)
4. Births during the year :—
   Total births.
5. Deaths during the year—
   (*a*) Total deaths.
   (*b*) Deaths ascribed to fever.
   (*c*) Deaths ascribed to blackwater fever.
   (*d*) Deaths ascribed to yellow fever.
6. Government Hospitals—
   (*a*) Number of such hospitals.
   (*b*) Totals, during year { admissions. deaths.
   (*c*) Malarial fever { admissions. deaths.
   (*d*) Blackwater fever { admissions. deaths.
   (*e*) Yellow fever { admissions. deaths.
   (*f*) Filarial Diseases { admissions. deaths.
   (*g*) Dengue { deaths. admissions.
7. Government Dispensaries :—
   (*a*) Number of such dispensaries.
   (*b*) Total attendances during year.
   (*c*) Attendances for malaria.
   (*d*) Attendances for filarial diseases.
   (*e*) Attendances for dengue.
8. Medical Service :—
   (*a*) Number of Government Medical Officers.
   (*b*) Number of special Health Officers.
   (*c*) Number of other registered practitioners.
9. Schools :—
   (*a*) Number of Government and State-Aided Schools.
   (*b*) Number of scholars registered in these schools.
   (*c*) Percentage of daily attendances.
10. Estates employing indentured labour :—
    (*a*) Number of such.
    (*b*) Number of indentured labourers employed.
    (*c*) Number of hospitals and dispensaries on such estates.
    (*d*) Total deaths among such labourers.
    (*e*) Deaths ascribed to malaria.
    (*f*) Total admissions and attendances at hospitals and dispensaries.
11. Estimated revenue of Colony :—
    Total during year.
12. Estimated expenditure of Colony :—
    (*a*) Total during year.
    (*b*) Annual medical and sanitary expenditure.

(*c*) Upkeep of Government hospitals and dispensaries.
(*d*) Total salaries and allowances of medical officers.
(*e*) Total annual sanitary expenditure.

13. Towns under Municipalities or Town Councils :—
(*a*) Number of such.
(*b*) Total population.
(*c*) Total revenues.
(*d*) Total medical and sanitary expenditure.

14. Table of deaths by Districts :—

District.	Area.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total															

15. Table of deaths in the principal towns :—

Town.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total															

16. Rainfall during the year :—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total														

17. Additional information to be given if possible on the following points :—
(*a*) Is there any legislation in force against the breeding of mosquitos in premises? Numbers of notices, convictions, and warnings during the year.
(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does Kala-azar exist?
(*c*) Number of persons examined for filarial diseases. Where this was done? Percentage affected.

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost.
(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.
(*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed.
(*g*) Is quinine distributed regularly in the schools?
(*h*) Measures taken against these diseases on estates employing indentured labour.
(*i*) Any steps taken regarding the housing of the poor.
(*j*) Any exceptional increase or decrease of these diseases recently noticed.
(*k*) Any other remarks on the subject.

No. 1.
CEYLON.
RETURN RELATING TO THE PREVENTION OF MOSQUITO-BORNE DISEASES DURING THE YEAR 1911.

(Received in Colonial Office, 12 October, 1912.)

As in previous years, the measures carried out were general improvements in the sanitation of some of the towns, the education of the public by lectures and pamphlets, and the free distribution of quinine. The most prevalent mosquito-borne disease was malaria. In the town of Kurunegala, in the North-Western Province, in September, 1911, an anti-malarial campaign was started and is still being carried out. A Medical Officer was seconded for this work alone, and Rs. 9,100 per annum was voted in addition to the ordinary sanitary expenditure. The conveying mosquito was determined, and its breeding places filled up or drained. Unfortunately about 260 acres of land in the town are under cultivation for rice, which forms a prevalent breeding place of the mosquito, and Government has this matter under consideration. It is too early yet to give any statistics as to the results of these measures.

2. A campaign on similar lines has been started in the town of Badulla, but there again the paddy fields are a prevalent breeding ground for the mosquito.

3. A male and female mosquito-proof ward has been provided in each Government Hospital in malarious districts.

4. It is to be regretted that the number of cases of malaria treated at Government Hospitals and Dispensaries has increased from 559,759 in 1910 to 925,934 in 1911, and the number of deaths from 249 in 1910 to 492 in 1911.

5. The draft return suggested by Professor Ronald Ross is appended.

RETURN of Malarial Fever, Blackwater Fever, Yellow Fever, Filariasis, and Dengue during the Year from 1st January to the 31st December, 1911.

1. Name of Colony : Ceylon.
2. Total area : 25,331⅝ square miles.
3. Estimated population :—

(*a*) Total	4,155,103*
(*b*) Europeans	7,637
(*c*)	
(*d*) Other races	4,147,466*
(*e*)	

4. Births during the year :—

Total births	156,401

5. Deaths during the year :—

(*a*) Total deaths	143,382
(*b*) Deaths ascribed to fever	34,939
(*c*) Deaths ascribed to blackwater fever	No deaths have been recorded from these causes.
(*d*) Deaths ascribed to yellow fever	

6. Government hospitals :—

(*a*) Number of such hospitals	77
(*b*) Totals during year :	
Admissions	68,442
Deaths	8,500

* Inclusive of immigrant coolies.

(*c*) Malarial fever :	
Admissions	11,877
Deaths	492
(*d*) Blackwater fever :	
Admissions	Nil.
Deaths	Nil.
(*e*) Yellow fever :	
Admissions	Nil.
Deaths	Nil.
(*f*) Filarial diseases :	
Admissions	7
Deaths	Nil.
(*g*) Dengue :	
Admissions	Nil
Deaths	Nil.
7. Government Dispensaries :—	
(*a*) Number of such Dispensaries	347
(*b*) Total attendance during year	1,936,168
(*c*) Attendances for malaria	857,492
(*d*) Attendances for filarial diseases	64
(*e*) Attendances for Dengue	Nil.
8. Medical service :—	
(*a*) Number of Government Medical Officers	300
(*b*) Number of Special Health Officers	4
(*c*) Number of other registered practitioners	92
9. Schools :—	
(*a*) Number of Government and State-aided schools ...	2,769
(*b*) Number of scholars registered in these schools	296,620
(*c*) Percentage of daily attendances	196,695
10. Estates employing unindentured labour :—	
(*a*) Number of such	2,202
(*b*) Number of unindentured labourers employed	387,652
(*c*) Number of hospitals and dispensaries on such estates...	307
(*d*) Total deaths among such labourers	15,645
(*e*) Deaths ascribed to malaria	1,713
(*f*) Total admissions and attendances at hospitals and dispensaries	402,206
11. Estimated revenue of Colony :—	
Total during year	Rs. 41,168,400
12. Estimated expenditure of Colony :—	
(*a*) Total during year	Rs. 52,864,331
(*b*) Annual medical and sanitary expenditure	2,735,247*
(*c*) Upkeep of Government hospitals and dispensaries ...	1,617,897*
(*d*) Total salaries and allowances of Medical Officers ...	494,924*
(*e*) Total annual sanitary expenditure	3,124*
13. Towns under Municipalities or Town Councils :—	
(*a*) Number of such	24
(*b*) Total population	374,574
(*c*) Total revenues	Rs. 3,595,409/69
(*d*) Total medical and sanitary expenditure	699,810/99

14. Table of deaths by districts :—*Vide* Annexure " A " (from Registrar-General).†

15. Table of deaths in the principal towns :—*Vide* Annexure " B " (from Registrar-General).

16. Rainfall during the year :—*Vide* Annexure " C " (from Surveyor-General).

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Numbers of notices, convictions, and warnings during the year.—In two towns only.

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* The figures given in (*b*) to (*e*) are for the financial year July, 1911, to June, 1912.
† Annexures not printed.

(*b*) Number of persons of the age of 15 examined for enlarged spleen.—109,526.
Where was this done?—At the various hospitals, dispensaries, and schools.
Percentage affected.—Spleen rate, 20·67.
Does kala-azar exist?—Kala-azar exists to a very slight extent.

(*c*) Number of persons examined for filarial diseases. Where was this done? Percentage affected. } As only eight persons were examined for filarial diseases the percentage would be of no value.

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost.—None.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.—In three or four towns small brigades are employed.

(*f*) Amount of Government quinine sold or distributed gratis during the year. —2,560 lbs. 7 ozs. Costing Rs. 128,199.83.
Agencies employed.—Chiefly through the headmen.

(*g*) Is quinine distributed regularly in the schools?—Yes, at 324 out of 731 Government schools.

(*h*) Measures taken against these diseases on estates employing unindentured labour.—Free quinine given and improvement in general sanitation in many estates.

(*i*) Any steps taken regarding the housing of the poor.—No.

(*j*) Any exceptional increase or decrease of these diseases recently noticed.—A general increase in malaria has been noticed in the majority of the provinces this year.

(*k*) Any other remarks on the subject.—*Vide* introductory remarks.

No. 2.

HONG KONG.

REPORT FOR THE YEAR 1911 ON THE PREVENTION OF MOSQUITO-BORNE DISEASES.

(Received May 13, 1912.)

1. Hong Kong.
2. Area:—
Island of Hong Kong, 32 square miles.
Kowloon, 16 square miles.
New Territories, 356 square miles (not included under any of the following statistics—wholly agricultural).
3. Census population (May 20th, 1911):—

Europeans	10,708
East Indians	4,066
Chinese and Malays	354,739
Mixed and Coloured	3,608
Total	373,121

4. Births:—

Non-Chinese	362
Chinese	1,406

5. Total deaths 7,748

Deaths ascribed to malarial fever	338
Deaths ascribed to blackwater fever ...	0
Deaths ascribed to yellow fever	0

6. (*a*) Civil Hospital (Government):—

Total admissions for the year	2,369
Total deaths for the year	173
Malarial fever admissions	112
Malarial fever deaths	2
Blackwater fever admissions	0
Blackwater fever deaths	0

Yellow fever admissions	0
Yellow fever deaths	0
Filarial diseases admissions	0
Filarial diseases deaths	0
Dengue admissions	0
Dengue deaths	0

(*b*) Victoria Hospital (Government) :—

Total admissions for the year	309
Total deaths for the year	9
Malarial fever admissions	30
Malarial fever deaths	0
Blackwater fever admissions	0
Blackwater fever deaths	0
Yellow fever admissions	0
Yellow fever deaths	0
Filarial diseases admissions	0
Filarial diseases deaths	0
Dengue admissions	0
Dengue deaths	0

No other Government Hospital other than the Infectious Diseases Hospital. The following hospitals are supported by voluntary contributions :—

(*c*) Tung Wah Hospital (Chinese) :—

Total admissions for the year	3,897
Total deaths for the year	1,211
Malarial fever admissions	289
Malarial fever deaths	108
Blackwater fever admissions	0
Blackwater fever deaths	0
Yellow fever admissions	0
Yellow fever deaths	0
Filarial diseases admissions	0
Filarial diseases deaths	0
Dengue admissions	0
Dengue deaths	0

(*d*) Alice Memorial and Affiliated Hospitals (for Chinese) :—

Total admissions for the year	1,332
Total deaths for the year	83
Malarial fever admissions	34
Malarial fever deaths	4
Blackwater fever admissions	0
Blackwater fever deaths	0
Yellow fever admissions	0
Yellow fever deaths	0
Filarial diseases admissions	1
Filarial diseases deaths	0
Dengue admissions	1
Dengue deaths	1

7. There are no Government Dispensaries, but there are native (Chinese) Dispensaries, supported by voluntary contributions and in charge of Chinese doctors trained in Western medicine. Returns herewith :—

(*a*) Number of such dispensaries	8
(*b*) Total attendances during the year (new cases only)	42,806
(*c*) Attendances for malaria (new cases)	2,781
(*d*) Attendances for filarial diseases	1
(*e*) Attendances for dengue	0

8. Number of Government Medical Officers	11
Number of special Health Officers (including 2 for the Port)	4
Number of other Registered Practitioners (exclusive of Military and Naval Medical Officers)	27

9. Schools :—

(*a*) Number of Government Schools 14
Number of State-aided Schools 53

(*b*) Number of Scholars registered in Government Schools 2,554
Number of Scholars registered in State-aided Schools 5,290

(*c*) Average daily attendance in Government Schools 2,120
Average daily attendance in State-aided Schools 4,183

10. Estates employing indentured labour ... ... none.

11. Estimated revenue of the Colony $7,086,383

12. Estimated expenditure of the Colony :—

(*a*) Total $7,385,320

(*b*) Annual medical expenditure $239,838
Annual sanitary expenditure $363,880

Total $603,718

(*c*) Upkeep of Government Hospitals :—
Salaries (including Bacteriological Institute) $161,695
Upkeep of Hospitals $75,448
Upkeep of Bacteriological Institute ... $2,695

Total $239,838

(*d*) Total salaries and allowances of Medical Officers (including Sanitary Department and Bacteriological Institute ... $91,994

(*e*) Total annual sanitary expenditure ... $363,880

13. No town under municipal control.

14. Table of deaths by districts :—

—	Area in square miles.	Population, 1911 Census. Chinese.	Non-Chinese.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
Victoria and Peak ...	4½	219,435	12,569	359	369	359	331	524	816	579	480	428	467	413	425	5,550
Villages of Hong Kong	27½	16,211	1,277	26	22	28	20	24	24	24	38	21	19	18	17	281
Kowloon	16	67,497	2,206	94	93	105	86	100	107	165	42	76	111	114	108	1,201
Harbour	—	51,293	2,633	59	50	44	49	67	76	66	61	71	67	49	57	716
	48	354,436	18,685	538	534	536	486	715	1,023	834	621	596	664	594	607	7,748

15. Victoria is the only town, and the figures are given in the following table.

16. Monthly table of rainfall :—

Where observed.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in inches.
Kowloon Observatory.	0·735	0·000	3·810	5·935	22·145	5·090	8·060	30·060	6·215	5·685	2·720	0·095	90·550

17. (*a*) No further legislation has been introduced to prohibit the breeding of mosquitoes; a copy of the bylaw in force was sent with the Report for 1910. During the past year 11 convictions were obtained for breaches of this bylaw, the fines amounting to $170.

(*b*) It has not yet been possible to make any spleen examinations in regard to children outside the various hospitals, for reasons given in the previous report. Kala-azar does not exist in the Colony.

(*c*) Filarial disease is uncommon in Hong Kong; frequent blood examinations are made in all the hospitals in search of these parasites.

(*d*) The training of nullahs in the vicinity of the city is still in progress, and during 1911 the sum of $24,650 was spent for this work. The total length of trained nullahs and cement channels built since the commencement of anti-malarial works in the Colony is 8·9 miles.

(*e*) The staff remains as in 1910—17 inspectors who give their whole time to sanitary work, five rural police who act also as sanitary inspectors, and 170 interpreters, foremen, artisans, and coolies, whose whole time is occupied in house-cleansing, disinfecting, clearing brushwood, and collecting receptacles for water from the hillsides and waste lands in the neighbourhood of dwellings, in oiling pools, and other sanitary and anti-malarial work.

(*f*) The amount of quinine issued free during the year was as follows:—

Government Hospitals	2,100 oz.
Tung Wah Hospital	210 oz.
Alice Memorial and Affiliated Hospitals ...	215 oz.
Public Dispensaries	563 oz.
Total	3,088 oz.

(*g*) Quinine has been regularly distributed during the year in certain schools in the most malarious part of the Colony.

(*h*) There are no estates employing indentured labour.

(*i*) The question of housing is dealt with in the Public Health and Buildings Ordinances—a copy of which was sent with the report for 1910.

(*j*) The total deaths from malaria during the past five years have been as follows:—

1907	579
1908	499
1909	422
1910	591
1911	338

The ratio per 1,000 of admissions to hospital for malaria among the British troops during the past five years has been as follows:—

1907	196·0
1908	256·0
1909	138·4
1910	177·0
1911	125·5

while among the Indian troops the ratios were:—

1907	574·0
1908	102·8
1909	54·3
1910	89·8
1911	31·8

These figures show on the whole a steady decrease in the malaria incidence of the Colony, which appears more marked when it is remembered that the population increased from 329,038 in 1906 to 372,989 in 1911. The reason for the high death-rate in 1910 was explained in the report for that year as being due to large building operations on the western confines of the city (*i.e.*, the University buildings), in the neighbourhood of untrained nullahs. These nullahs were trained *pari passu* with the construction of the buildings, but it is usual here for builders and other workmen employed on construction works to reside in matsheds on the site, and consequently they are exposed to the bites of anopheline mosquitoes at night, with the result that malarial infection spreads rapidly among them. Even during 1911 more than 26 per cent. of the deaths occurring in the city came from No. 9 Health District, which is the district nearest to these building operations. In any future large constructional works it is hoped that it will be possible to arrange for the workmen to be

housed between sundown and sunrise in sheds at least 600 yards distant from their place of their work and on a site free from mosquitoes.

Another feature of our malarial infection which was also commented on in the last report is the constant movement of the native population between Hong Kong and the delta of the Canton River—nearly 4,000 natives leave Hong Kong daily by river boats and about the same number arrive daily.

Special classes are held in all the schools of the Colony for instruction in hygiene, which includes a description of the part played by mosquitoes in the transmission of malaria, and a considerable quantity of literature on this subject—both in English and Chinese is distributed yearly to the community.

FRANCIS CLARK, M.D., M.R.C.P., D.P.H.,
Medical Officer of Health.

March 29th, 1912.

No. 3.

MAURITIUS.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR ENDED 31st DECEMBER, 1911.

(Received November 16th, 1912.)

1. Name of Colony : Mauritius.
2. Total area : 720 square miles.
3. Estimated population on 31st December, 1911 :—
   (*a*) Total population : 372,174 (exclusive of military : 1,375).
   (*b*) General „ 109,203.
   (*c*) Indian „ 258,541.
   (*d*) Chinese „ 4,530.
4. Births during 1911 : 14,584.
5. Deaths during 1911 :—
   (*a*) 12,204.
   (*b*) 4,313 ascribed to fever.
   (*c*) One ascribed to blackwater fever.
   (*d*) Nil ascribed to yellow fever.
6. Government Hospitals :—
   (*a*) Number : 14.
   (*b*) Totals during the year of admissions : 17,657; deaths, 1,161.
   (*c*) Malarial fever : admissions, 2,011; deaths, 10.
   (*d*) Blackwater fever : One.
   (*e*) Filarial diseases : admissions, 24; deaths, nil.
   (*f*) Yellow fever : Nil.
   (*g*) Dengue : Nil.
7. Government Dispensaries :—
   (*a*) Number : 29.
   (*b*) Total attendances : 62,384.
   (*c*) Attendances for malaria : 18,604.
   (*d*) Attendances for filarial diseases : 35.
   (*e*) Attendances for dengue : Nil.
8. Medical Service :—
   (*a*) Number of Government Medical Officers : 36.
   (*b*) Number of special Health Officers : 9.
   (*c*) Number of other registered practitioners : 31.
9. Schools :—
   (*a*) Number of Government and State-Aided Schools : 148.
   (*b*) Number of scholars registered in these schools : 21,010.
   (*c*) Percentage of daily attendances :—
      (i) Government Schools : 64.
      (ii) Aided Schools : 68.

10. Estates employing indentured labour :—
  (*a*) Number : 104.
  (*b*) Number of indentured labourers employed : 33,331.
  (*c*) Number of hospitals and dispensaries : 94.
  (*d*) Total deaths among such labourers : 960.
  (*e*) Deaths ascribed to malaria : not available.
  (*f*) Total admissions and attendances at hospitals and dispensaries : not available.

11. Estimated revenue of the Colony for 1911-1912 : Rs. 10,400,700.

12. Estimated expenditure of the Colony in 1911-1912 :—
  (*a*) Total during the year : Rs. 9,914,455.
  (*b*) Annual medical and sanitary expenditure : Rs. 840,000.
  (*c*) Upkeep of Government hospitals and dispensaries : Rs. 483,557.
  (*d*) Total salaries and allowances of medical officers : Rs. 118,130.
  (*e*) Total annual sanitary expenditure : Rs. 334,767.

13. Towns under Municipalities and Town Councils :—
  (*a*) Number : 4.
  (*b*) Total population : 80,909.
  (*c*) Total revenues : Rs. 629,841.
  (*d*) Total medical and sanitary expenditure : Rs. 97,387.

14. Table of deaths by districts :—
  (See Annexure A.)

15. Table of deaths in the principal towns :—
  (See Annexure B.)

16. Rainfall during the year :—
  (See Annexure C.)

17. (*a*) There is no legislation in force against the breeding of mosquitos in premises.
  (*b*) Number of children examined for enlarged spleen :—
    (i) Half-year ended 30 June, 1911 : 21,010.
    (ii) Half-year ended 31st December, 1911 : 20,997.
  Examinations were carried in the Government and Aided Schools.
  Spleen rate :—
    1st half-year : 22·16 per cent.
    2nd half-year : 20·83 per cent.
  Kala-azar is non-existent.
  (*c*) No examination was undertaken for filarial diseases.
  (*d*) Surface-drainage works have been undertaken in the town of Port Louis at a cost of Rs. 2,273.32. (See also Annexure D.)
  (*e*) Number of men employed in anti-mosquito work : 45; at a cost of Rs. 750 per mensem.
  (*f*) No Government quinine was sold. Amount distributed gratis is 184 lbs 1 oz. 354 grs. This distribution was effected by (i) men employed by the Municipality of Port Louis, (ii) schoolmasters, and (iii) dispensary stewards.
  (*g*) Quinine is, as far as possible, distributed in a regular way in the schools.
  (*h*) Anti-malarial measures were undertaken on the following estates : Ferney, Le Vallon, Riche-en-Eau, Le Val, Mon Desert, Medine, L'Etoile, Rich Fund, Mon Rocher, Albion, Rosalie-Constance, Bel Ombre, L'Union, Fontenelle, Britannia, Bel Air (Hardouin).
  (*i*) No steps are taken regarding the housing of the poor.
  (*j*) Malaria was on the decrease in 1911.
  (*k*) Anti-malarial measures were brought to a conclusion on the following estates : St. Hubert, Beau Vallon, La Baraque, Deux Bras, Gros Bois. Joli Bois, St. Avold, St. Aubin, St. Antoine, Bassin, Labourdonnais, Belle Vue Harel, Belle Vue Pilot, Alma, Valetta.

Annexure A.

Number of Deaths in Mauritius during 1911.

Districts.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Grand total.
Port Louis	206	151	192	183	156	178	179	195	202	194	165	164	2,165
Pamplemousses	87	86	88	106	85	85	103	124	111	139	104	120	1,238
Riviere du Rempart	69	65	89	105	59	47	73	66	63	78	64	65	843
Flacq	129	125	147	152	140	131	155	183	186	160	132	156	1,796
Grand Port	100	127	133	136	127	158	182	189	157	191	167	128	1,795
Savanne	59	66	111	88	84	84	97	113	87	110	83	86	1,068
Plaines Wilhems	173	160	154	119	121	131	167	149	135	172	132	174	1,787
Moka	90	103	78	70	61	74	94	74	73	69	82	66	934
Black River	45	35	54	37	41	41	55	65	54	59	49	43	578
Total	958	918	1,046	996	874	929	1,105	1,158	1,068	1,172	978	1,002	12,204

Annexure B.

Number of Deaths in the Principal Towns of Mauritius during the year 1911.

Towns.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Port Louis	143	113	143	154	124	142	153	154	153	159	129	127	1,694
Curepipe	40	26	27	27	21	17	31	30	25	24	20	25	313
Beau Bassin ... ... / Rose Hill	38	31	27	12	17	24	19	29	22	38	24	26	307
Quatre Bornes	10	11	19	13	12	14	12	16	8	16	18	22	171

Annexure C.

Rainfall in 1911.

Where Observed.	District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
R.A. Observatory.	Pamplemousses.	8·09	12·68	12·13	1·83	1·15	3·86	0·68	1·12	1·08	0·32	0·26	3·10	46·30
Beau Bassin ...	Plaines Wilhems.	7·49	12·88	17·98	1·45	1·18	2·94	1·01	0·76	0·36	0·00	0·64	1·74	48·43
Curepipe ...	Do. do.	11·85	28·28	39·01	8·36	3·34	7·37	6·11	7·28	5·02	0·72	0·67	4·96	122·97
Alma	Moka ...	13·21	32·48	38·66	8·44	3·98	7·32	5·47	6·56	4·65	0·81	1·19	5·08	127·85
Means ...	... ...	10·16	21·58	26·95	5·02	2·41	5·37	3·32	3·93	2·78	0·46	0·69	3·72	86·39

Annexure D.

Surface Drainage Works carried out in the Towns in 1911.

Quatre Bornes.—Drains along the St. Jean main road were constructed as follows:—

696 ft. drain, 1 ft. 6 in. wide, with a 9 in. sewer.
350 ft. drain, 2 ft. wide, with a 12 in. sewer.
190 ft. drain, 2 ft. 6 in. wide, with a 14 in. sewer.

A masonry culvert 62 ft. long was reconstructed and provided with a 14 in. sewer. Cost: Rs. 3,155.32.

Port Louis.—St. Lazare, Lataniers River.

The course of the river was trained on a total length of 2,800 feet. Blasting was done on a length of 1,825 feet, and artificial banks constructed on a length of 3,000 feet. Cost: Rs. 842.95.

(Extra urban area.) The construction of the Camp Nattou drain, 6 in. wide, was continued on a length of 1,024 feet at a cost of Rs. 2,273.32.

(Continuation of Works.)

Quatre Bornes.—La Louise drain was cleaned and the construction continued at a cost of Rs. 4,300.

No. 4.

STRAITS SETTLEMENTS.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM 1st JANUARY TO 31st DECEMBER, 1911.

(Received in Colonial Office, 29 July, 1912.)

1. Name of Colony: Straits Settlements. They include Singapore, Penang, Malacca, Labuan, Province Wellesley, Dindings, Christmas Island, and Cocos-Keeling Islands.

2. Total area:

	Square miles.
Singapore	217·5
Labuan	28·6
Christmas Island	61·8
Cocos-Keeling Islands	—
Penang	108·1
Prov. Wellesley	280·4
Dindings	182·8
Malacca	720·5
Total, Colony	1,599·7

3. Population:

Actual population as per Census, 1911, was:

(a) Total		714,069
(b) Europeans	7,368	
(c) Chinese	369,843	
(d) Other races	96,652	
(e) Malays	240,206	
	714,069	

4. Births during the year:

Total births registered was		18,069

5. Deaths during the year:

(a) Total deaths registered was		33,072
(b) Deaths ascribed to fever:		
Malaria	5,821	
Typhoid	133	
Not specified	4,826	
		10,780
(c) Deaths ascribed to blackwater fever (see 6 (d) below) ...		1
(d) Deaths ascribed to yellow fever		Nil.

6. Government hospitals:

(a) Number of such hospitals, 29, including lunatic asylum.

(b) Totals during the year for admissions	44,246
Deaths	6,124
(c) Malarial fever: admissions	11,815
Deaths	1,014

(*d*) Blackwater fever: admissions ...	4
Deaths ...	1
(*e*) Yellow fever: admissions ...	Nil.
Deaths ...	Nil.
(*f*) Filarial diseases: admissions ...	19
Deaths ...	Nil.
(*g*) Dengue: admissions ...	18
Deaths ...	1

7. Government dispensaries:

(*a*) No.:

Singapore ...	2
Labuan ...	1
Penang ...	2
Province Wellesley ...	3
Dindings ...	1
Malacca ...	3
Total ...	12

(*b*) Total attendances during the year:

Singapore ...	10,517
Labuan ...	915
Penang ...	17,199
Province Wellesley ...	10,579
Dindings ...	994
Malacca ...	4,243
Total ...	44,447

(*c*) Total attendances for malaria:

Singapore ...	2,209
Labuan ...	479
Penang ...	472
Province Wellesley ...	364
Dindings ...	353
Malacca ...	686
Total ...	4,563

(*d*) Attendances for filarial diseases:

Labuan ...	1
Malacca ...	3
Total ...	4

(*e*) Attendances for Dengue:
Singapore, 73.

8. Medical service:

(*a*) Number of Government Medical Officers, 23.
Number of Government Assistant Surgeons, 26.
Number of Municipal Medical Officers, 6.

(b) Number of Special Health Officers:
Government, 4, all for port work.
Municipal, 6.

Health work elsewhere is carried out by the District Medical Officers. Two Health Officers for country work are being asked for.

(*c*) Number of other registered practitioners:
In private practice, 144.

9. Schools:

(*a*) The number of Government and State-aided schools:
Total, 218.

(*b*) The number of scholars registered in these schools. See following statement.

(*c*) Percentage of daily attendances for 1911. See following statement.

——	Number of Schools.	Average Enrolment.	Average Attendance.
SINGAPORE.			
English Schools.			
Government Schools, Boys' and Girls' ...	5	1,955	1,839
Aided Schools, Boys' and Girls'	11	4,531	4,246
Vernacular Schools.			
Government Schools, Boys' and Girls' ...	17	1,282	1,049
Aided Schools, Boys' and Girls'	—	—	Nil.
MALACCA.			
English Schools.			
Government Schools, Boys' and Girls' ...	2	460	436
Aided Schools, Boys' and Girls'	4	730	675
Vernacular Schools.			
Government Schools, Boys' and Girls' ...	77	4,993	4,267
Aided Schools, Boys' and Girls'	—	—	Nil.
PENANG.			
English Schools.			
Government Schools, Boys' and Girls' ...	1	204	182
Aided Schools, Boys' and Girls'	13	4,459	4,078
Vernacular Schools.			
Government Schools, Boys' and Girls' ...	86	5,744	4,965
Aided Schools, Boys' and Girls'	2	62	52

10. Estates employing indentured labour.

[The following figures are in respect of both indentured and free labour as very few estates employ indentured labour.]

(*a*) Of large estates there are :
In Singapore, 9.
„ Penang, 1.
„ Province Wellesley, 16.
„ Malacca, 30.

but there are in addition a very large number of small estates privately owned employing a few labourers only.

(*b*) Number of labourers employed :
Singapore, 2,312.
Penang, 84.
Province Wellesley, 8,025.
Malacca, 26,915.

These numbers are in connection with the above 56 estates.

(*c*) Number of hospitals and dispensaries on such estates :
Singapore, 2.
Penang, 1.
Province Wellesley, 12.
Malacca, 12.

(*d*) Total deaths among such labourers :
Singapore, 23.
Penang, 5.
Province Wellesley, 129.
Malacca, 572.

(*e*) Deaths ascribed to malaria :
Singapore, 3.
Penang, nil.
Province Wellesley, 14.
Malacca, 242.

(*f*) Total admissions and attendances at estate hospitals and dispensaries :
Singapore, 608.
Penang, 333.
Province Wellesley, 10,549.
Malacca, 15,988.

NOTE —Before passing to question 11 I must point out that the figures given in answers (*a*) to (*f*) in question 10 above are not dependable. As I have before mentioned, in all settlements there are a large number of small estates owned by natives—the labour force being usually their own relatives or neighbours. Their inability to answer in full such queries as are put to them to obtain the required figures, and the fear of the natives to Governmental interference stand as a barrier to supplying statistics of a reliable nature. In Province Wellesley and Malacca, where the Malays are more in their natural condition, keen on agriculture and husbandry, this difficulty will be almost unsurmountable, and until a special officer to be appointed shortly for estate supervision can send in report of a year's work I shall be unable to hold out any hopes of supplying reliable statistics of the nature called for.

11. Estimated revenue of Colony :

[The following figures are exclusive of Municipalities, for which please see item 13 (*c*) below.]

Colonial revenue	$10,680,159
Hospital Board revenue	230,841
Rural Board revenue	493,668
Education Board	202,724
	$11,607,392

12. Estimated expenditure :

Colonial expenditure	$9,453,410
Hospital Board expenditure	230,841
Rural Board expenditure	542,766
Education Board expenditure	202,724
(*a*) Total during year	$10,429,741

(*b*) Annual medical and sanitary expenditure inclusive of salaries :

Colony	$509,040
Hospital Board	269,510
Rural Board	24,348
	$802,898

(*c*) Upkeep of Government hospitals and dispensaries :

Total during the year	$428,850

(*d*) Total salaries and allowances of Medical Officers, 1911 ...	$99,475
(2) Assistant Surgeons	50,584
	$150,059

(*e*) Total annual sanitary expenditure :

Public Works Department	$128,000
Port Health Officer	26,211
Rural Board	21,268
Total	$175,479

[The above figures for (*a*), (*b*), (*c*), (*d*), and (*e*) are exclusive of municipalities.]

13. Towns under municipalities or town councils :

(a) Number of such, 3.

(b) Population :—

Singapore	259,610
Penang	101,182
Malacca	21,191
Total	381,983

(c) Total revenues :

Singapore	$3,024,250
Penang	1,331,478
Malacca	91,828
	$4,447,556

(d) Total medical and sanitary expenditure :

——	Singapore.	Penang.	Malacca.	Total.
	$	$	$	$
1. Health Officer's Department ...	107,125	30,415	4,981	142,521
2. Cemeteries	11,958	—	—	11,958
3. Conservancy	202,669	154,440	8,215	365,324
4. Disposal of Refuse	40,859	—	—	40,859
5. Disposal of Night Soil	18,788	—	5,098	23,886
6. Sewerage and Disposal	5,632	—	—	5,632
7. Malaria Prevention	10,000	—	—	10,000
8. Drainage	62,349	40,325	1,789	104,463
9. Pathological Department, &c. ...	8,700	28,502	—	37,202
10. Improvement Schemes	177,184	60,868	—	238,052
11. Quarantine Camp	62,149	700	—	62,849
12. Sanitary Improvements, back lanes	49,355	18,705	—	68,060
13. Incinerators	41,647	3,769	—	45,416
14. Re-forming Town Drains ...	2,097	—	—	2,097
Total	800,512	337,724	20,083	1,158,319

14. Table of deaths by districts :—

District.	Area. Square Miles.	Population.	Total Deaths.												Total.
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	
Singapore ...	217	303,321	1,000	751	944	1,250	1,992	2,167	1,602	1,240	1,112	1,263	1,100	1,078	15,499
Penang ...	108	141,559	434	400	467	473	621	625	874	482	358	389	368	392	5,883
Prov. Wellesley	280	128,978	321	273	312	368	382	379	349	316	320	353	309	297	3,979
Dindings ...	183	7,466	47	36	24	21	18	32	34	25	32	33	29	38	369
Malacca ...	720	124,081	668	507	463	559	647	783	736	598	494	529	526	649	7,159
Labuan ...	28	6,546	21	21	15	21	16	10	15	14	14	8	11	17	183
Total ...	...	...	2,491	1,988	2,225	2,692	3,676	3,996	3,610	2,675	2,330	2,575	2,343	2,471	33,072

15. Table of deaths in the principal towns :—

Town.	Population.	Total Deaths.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Singapore	259,610	867	626	787	1,076	1,735	1,857	1,304	1,028	955	1,083	958	941	13,217
Penang	101,182	334	288	330	311	381	359	333	286	287	300	287	285	3,781
Malacca	21,191	98	62	71	97	111	144	127	93	106	119	93	102	1,223
Total	...	1,299	976	1,188	1,484	2,227	2,360	1,764	1,407	1,348	1,502	1,338	1,328	18,221

16. Rainfall during the year :—

Where observed.	Rainfall.												
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Singapore	44·97	3·19	1·20	4·05	10·06	3·15	3·35	7·48	5·89	9·41	18·15	11·79	92·69
Penang	2·84	2·10	3·81	10·19	8·84	7·84	3·84	8·67	11·02	13·82	8·70	4·01	85·68
Dindings	8·72	2·02	3·18	3·68	4·71	2·16	5·10	4·28	12·96	11·30	11·56	12·52	82·19
Province Wellesley	2·97	1·22	3·40	7·61	3·66	4·25	3·70	5·17	7·30	13·90	11·60	3·87	68·65
Malacca	2·31	1·84	4·35	6·24	3·65	2·26	3·88	7·58	6·17	4·28	10·06	6·07	58·69
Labuan	5·24	2·39	·69	9·44	11·47	7·00	11·25	8·37	9·15	26·18	4·57	4·07	99·82
Total	37·05	12·76	16·63	41·21	42·39	26·66	31·12	41·55	52·49	78·89	64·64	42·33	487·72

17. (*a*) The Municipal Ordinance is being revised *in toto*, and sections are to be added dealing with the breeding of mosquitoes, prevention of malaria, &c.

In the middle of the year a Malaria Commission was formed in Singapore and $20,000 voted in the first instance for expenditure upon malaria prevention. A pathologist is being procured from home to relieve Dr. Finlayson, the Government Pathologist, so that the latter officer may be seconded for special duty in this connection, and he will begin work nearly immediately, with the view of formulating some considered schemes for the stamping out of all anopheline breeding places within Singapore municipal limits. A start has already been made upon one of the worst districts. Later, other portions of the Settlements are to be taken in hand.

Throughout the year minor works have been undertaken by the Health Departments of all municipalities as well as the clearing of drains and oiling of pools.

In Singapore the Municipal Health Department served notices during the year to fill up or drain 102 pieces of low-lying ground—of these notices 25 have been complied with. The low-lying ground varied in size from ¼ acre to 23 acres.

(*b*) *Spleen rate:*

——	Children Examined.	Splenic Enlargement.	Percentage
Singapore	1,314	127	9·6
Malacca	3,057	470	15·37
Penang	2,732	215	7·8
Labuan	70	42	60·0
Total	7,173	854	11·91

The above table shows 7,173 children were examined for enlarged spleen, of whom 854 were found affected, which is equal to a percentage of 11·91.

The examination was conducted at the schools, except at Labuan where a few were examined at the police barracks and hospitals. All examined at Labuan were evidently suspects. Only two or three cases of kala-azar have been noted in the Straits Settlements, probably introduced, as no authentic case originating in the Colony has been observed.

(*c*) *Number of persons examined for filarial diseases.*—No special examinations are made under this head.

(*d*) *Surface drainage, &c. Singapore.*—Reclamation at Mount Zion was continued from last year. 184,547 tons of dredgings from Singapore River were deposited during the year at a cost of $38,637.

Low-lying ground at Penang Lane was raised (an area of 28,458 square feet) at a cost of $989.

Low-lying land at New Bridge Road, opposite the General Hospital, was filled up. Area, 157,904 square feet at a cost of $9,450.

Government House grounds. A portion was filled to a uniform fall and turfed and a concrete invert provided for $2,249.

The low-lying grounds and roads round the Central Police Station were raised and improved at a cost of $520.

Penang.—New drains at Tanjong Tokong Village were completed at a cost of $4,474.

New drains at Balik Pulau Village were completed at a cost of $2,498.

New drains at Nebong Tebal Village were completed at a cost of $3,080.

Extension and repairs to drains in Province Wellesley at a cost of $3,000.

Malacca.—No works of this nature were carried out during the year.

(*e*) *Men employed on petty anti-mosquito works. Singapore.*—None—outside municipal limits. All Municipal Sanitary Inspectors (18) did a certain amount of work in this connection.

Penang.—There were 68 men (daily average) employed on such service at a cost of $8,227.

Malacca.—No special men were engaged, but the three Sanitary Inspectors were put on anti-malarial duty in addition to their ordinary duties. They reported on the presence of breeding places of mosquitoes, instructed house-holders to fill in ponds, clean drains, bury empty tins and bottles, &c. An additional Inspector was put on this duty for one especially insanitary area. The Assistant Surgeon at the General Hospital and the Deputy Registrar of Deaths assisted the Health Officer by making periodic visits of inspection in the town, while the Assistant Surgeons at Jasin and Alor Gajah did similar work in their respective districts.

Labuan.—The prisoners were employed on and off throughout the year in filling up swamps and draining land. It is not possible to give the cost of such works.

(*f*) *Amount of Government quinine sold or distributed. Singapore.*—4,900 grains were distributed gratis by the Assistant Municipal Health Officers.

Penang.—500 grains were given to children in the two Vernacular Schools through the teachers, and an uncertain quantity given to coolies and others in the municipal service.

Malacca.—Distribution of quinine was started late in the year—in all 4 lbs. 4 ozs. were given away. Thirty-two lbs. of quinine were used in the hospitals for in-patients and out-patients, and 1 lb. was distributed throughout the schools in the Settlements.

Labuan.—143 ounces of quinine were distributed during the year to patients and others applying for it at the Government Dispensary.

(*g*) There is no regularity in the distribution of quinine at the schools, but it is given away through the teachers as needed.

(*h*) No special measures were taken by Government; but estates had their own Medical Officers working for the suppression of these diseases. The protection of health of estate labourers came up for consideration during the year, and an ordinance was passed and a Health Department is to be instituted for the purpose.

(*i*) No special measures were taken in this respect.

The ordinary work of the Sanitary Inspectors includes the inspection of houses and the work in this connection shows that the housing of the poor has very greatly improved as far as the structure, &c., of the building is concerned. The great difficulty is in getting the occupants to observe ordinary ideas of cleanliness and ventilation. The overcrowding of houses on areas is being dealt with gradually, and reserves for back lanes are now getting numerous, and in some places the lanes have been made. Overcrowding from a legal point of view is uncommon, but the occupants do not make use of the means of ventilation provided, *e.g.*, windows and ventilation openings are closed up.

During the year in Singapore a commencement was made with the Kampong Kapur Improvement Scheme, which had been approved by His Excellency the Governor. This is an area extending to about 50 acres, and consists generally of low-lying ground with numerous swamps. The general idea of the scheme is to split the area up with roads and back lanes, the demolition of insanitary and obstructive houses, the filling in of swamps, and raising of low-lying ground.

The work done during the year was as follows :—

Drains made, 6,205 feet.

Roads made (including back lanes), 5,000 feet.

Filling in, 5,916 loads at a cost of $11,093. In addition, $162,763 was expended in purchase of lands and compensations for houses, &c., demolished.

2,406 houses were returned as vacant at Census of 1911.

(*j*) As to exceptional increase or decrease of these diseases recently noticed. For purposes of this report it will be sufficient to take malaria only, the other diseases forming the subject of this report being few or unknown.

The admissions for and deaths from malaria at all the hospitals of the Colony for the last nine years are given below. In order to remove any misconception that may arise as to the percentage of deaths (as the deaths include those remaining from the previous year) the total treated is also given :—

—	Remaining.	Admitted.	Total.	Deaths
1903	89	2,163	2,252	177
1904	38	2,547	2,585	188
1905	59	2,752	2,811	286
1906	46	2,791	2,137	251
1907	98	4,261	4,359	295
1908	108	4,617	4,725	509
1909	137	4,946	5,083	431
1910	103	7,330	7,433	690
1911	123	11,815	11,938	1,014

There can be no doubt that the above figures are for *bonâ fide* "malaria" cases, since they have been furnished from Government hospitals where the patients were treated. The population in 1903 was estimated at 588,544, which had increased to 714,069 in 1911 : this would mean that the percentage of admissions to the population, which in 1903 was ·367, had risen to 1·12 for malaria in 1910 and 1·68 in 1911, which was an exceptional year. As to the incidence of malaria in 1911, there is no doubt that the Colony has been through a severe epidemic.

In Singapore the deaths from malaria reported by the Registrar-General weekly began to rise in May, 1911. The weekly average number of deaths from this cause for 1910 was about 41; in the first week of May, 1911, there were 113, which rate fell by the end of the month to 82.

It shot up to 127 in the second week in June, and remained at much the same rate until July, when it receded and resumed its ordinary rate. About this time in Malacca and Penang (not so seriously in the latter place) similar conditions prevailed. The Medical Officer, Malacca, writes in his annual report "severe outbreaks of malaria fever occurred throughout the Settlement, and estates which never before had malaria showed a severe incidence. March, April, May, June, July, August, and September saw the disease at its worst. During these months the admissions into the hospitals were greatly increased. The outbreak was general in town as well as country. Streets where malaria was formerly little known had several cases of locally-contracted disease. The great majority were of the malignant type."

W. GILMORE ELLIS,
Principal Civil Medical Officer,
Straits Settlements.

No. 5.

NYASALAND.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR, FROM THE 1ST JANUARY TO THE 31ST DECEMBER, 1911.

(Received in Colonial Office, April 13, 1912.)

1. Name of Colony :—Nyasaland Protectorate.
2. Total area :—39,801 square miles.
3. Estimated population :—
   (*a*.) Total, 970,430.
   (*b*) Europeans, 766.
   (*c*) Asiatics, 481.
   (*d*) Africans, 969,183.
4. Births during the year :—
   Total births (no record).
   (*a*) Europeans, 21.
   (*b*) Asiatics, 1.
   (*c*) Africans (no record).

5. Deaths during the year :—

Total deaths (no record).

(a) Europeans, 9.
(b) Asiatics, 3.
(c) Africans (no record).

Deaths ascribed to fever, 1.
Deaths ascribed to blackwater fever, 3.
Deaths ascribed to yellow fever, nil.

6. Government Hospitals :—

(a) Number of such hospitals, 4.

(b) Totals, during year :—	
Admissions	1,286
Deaths	29
(c) Malarial fever :—	
Admissions	224
Deaths	1
(d) Blackwater fever :—	
Admissions	5
Deaths	3
(e) Yellow fever :—	
Admissions	Nil.
Deaths	Nil.
(f) Filarial diseases :—	
Admissions	2
Deaths	1
(g) Dengue :—	
Admissions	Nil.
Deaths	Nil.

7. Government dispensaries :—

(a) Number of such dispensaries, 5.
(b) Total attendances during the year, 10,058.
(c) Attendances for malaria, 490.
(d) Attendances for filarial diseases, 19.
(e) Attendances for dengue, nil.

8. Medical service :—

(a) Number of Government Medical Officers, 11.
(b) Number of special health officers, nil.
(c) Number of other registered practitioners, 14.

9. Schools :—

(a) Number of schools, 1,237.
(b) Number of scholars registered in these schools, 95,137.
(c) Percentage of daily attendances, 61,936.

10. Estates employing indentured labour, nil.

11. Estimated revenue of Colony :—

Total during year, £94,980. (Financial year.)

12. Estimated expenditure of Colony :—

(a) Total during year, £118,089. (Financial year.)
(b) Annual medical and sanitary expenditure, £8,858.
(c) Upkeep of Government hospitals and dispensaries, £590.
(d) Total salaries and allowances of Medical Officers, £4,927.
(e) Total annual sanitary expenditure (no record).

13. Towns under municipalities or town councils :—

(*a*) Number of such, 6.
(*b*) Total population (no complete record).
(*c*) Total revenues, about £492.
(*d*) Total medical and sanitary expenditure (no reliable record).

14. Table of deaths by districts, no record.

15. Table of deaths by towns :—

Town.	Total Deaths.												
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Fort Johnston.	—	—	—	—	1	1	1	—	—	—	—	1	4
Chiromo / Port Herald.	No record.												
Blantyre	1	2	—	—	3	2	—	1	1	2	1	2	15
Zomba ...	2	2	3	2	4	2	3	5	2	4	3	5	37
Total	3	4	3	2	8	5	4	6	3	6	4	8	56

16. Rainfall during the year :—

District.	Where observed.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total Inches.
Lower Shire ...	Port Herald ...	11·39	8·11	1·77	·56	1·87	1·24	·54	·33	·69	Nil.	5·47	2·89	34·86
Ruo	Chiromo ...	10·42	10·24	3·52	Nil.	1·35	2·33	1·41	Nil	1·10	·30	Nil.	2·72	33·39
West Shire ...	Chikwawa ...	9·29	7·81	3·84	·73	2·39	2·29	1·61	Nil.	·29	·44	·29	3·66	32·64
" ...	Neno	17·37	8·94	7·27	2·78	9·84	2·04	1·08	·34	·25	·40	7·15	7 54	65·00
" ...	Mwendangombe	13·77	6·42	6·38	5·63	6·51	1·90	1·09	·49	·09	Nil.	5·58	5·61	53·47
Blantyre ...	Blantyre (Govt.)	15·26	8·17	6·04	2·56	2·53	1·35	·70	·14	·07	1·35	1·77	6·78	46·72
Mlanje ...	Fort Anderson	12·42	16·86	11·03	7·97	11·06	6·74	2·57	1·23	1·70	1·05	1·06	7·63	81·32
" ...	Likulesi ...	12·51	8·14	4·74	1·23	·88	·38	Nil.	·28	Nil.	Nil.	3·27	8·07	39 50
Zomba ...	Zomba (Obs.)	10·77	13·41	6·13	3·97	4·50	1·20	·21	·36	·19	1·09	4·00	10 45	56·28
" ...	Domasi Mission	4·83	14·07	6·93	5·43	3·11	Nil.	Nil.	1·05	·78	2·32	2·95	9·18	50·65
Upper Shire ...	Liwonde ...	10·08	6·66	6·27	1·40	·88	·47	·20	·26	·57	Nil.	2·56	7·89	37·24
" ...	Ncheu ...	9·44	8·48	5·66	1·38	1·22	·16	Nil.	Nil.	Nil.	1·80	1·72	7·80	37·66
South Nyasa ...	Fort Johnston	4·28	5·63	5·73	·47	·82	·60	·12	·10	Nil.	1·04	1·61	5·77	26·17
Momberas ...	Mzimba ...	6·89	6·69	3·07	·75	·13	·07	Nil.	Nil.	Nil.	Nil.	·94	4·10	22·55
West Nyasa ...	Kawiya ...	4·31	7·39	13·76	9·38	9·11	1·05	·18	·25	·53	Nil.	2·47	5·66	54·09

17. Additional information :—

(*a*) Yes, record of three notices only.
(*b*) One hundred and six. In Blantyre and Zomba 8 per cent.
(*c*) Twenty-one. Port Herald and Zomba.
(*e*) Nil.
(*d*) No reliable record.
(*f*) Quinine is distributed gratis to European officials and natives in the principal towns.
(*g*) To a limited extent.
(*h*) Does not apply.
(*i*) Does not arise.
(*j*) Nothing noteworthy
(*k*) The above information is based on the returns furnished by the Medical Officers of Port Herald, Blantyre, Zomba, and Fort Johnson. No returns have up to the present been received from medical practitioners in the Protectorate, but all have been duly informed, and invited to co-operate in the preparation of this return.

No. 6.

SIERRA LEONE.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1ST OF JANUARY TO THE 31ST OF DECEMBER, 1910.

(Received in Colonial Office, January 29, 1912.)

1. Name of Colony : Sierra Leone.
2. Total area : 30,000 square miles.
3. Estimated population :—
   (a) Total, 1,314,000.
   (b) Europeans, 831.
   (d) Other races : East Indians, 21; Syrians, 146.
4. Births during the year :—
   Total births : Freetown, 581. (Freetown population estimated 34,010.)
5. Deaths during the year :—
   (a) Total deaths (Freetown), 936.
   (b) Deaths ascribed to fever, 122 (from Registrar of Deaths' records).
   (c) Deaths ascribed to blackwater fever, 4.
   (d) Deaths ascribed to yellow fever, 10.
6. Government hospitals :—
   (a) Number of such hospitals, 11.
   (b) Totals during year : admissions, 2,295; deaths, 167.
   (c) Malarial fever : admissions, 184; deaths, 5 (From hospital records).
   (d) Blackwater fever : admissions, 10; deaths, 4.
   (e) Yellow fever : admissions, 13; deaths, 10; and 10 suspicious cases with 1 death.
   (f) Filarial diseases : admissions, 11; deaths, 1.
   (g) Dengue : admissions, Nil; deaths, Nil.
7. Government dispensaries :—
   (a) Number of such dispensaries, 18.
   (b) Total attendances during year, 81,273.
   (c) Attendances for malaria, 2,271.
   (d) Attendances for filarial diseases, 7. (Full number not classified.)
   (e) Attendances for dengue, Nil.
8. Medical service :—
   (a) Number of Government Medical Officers, 18.
   (b) Number of special Health Officers, 2.
   (c) Number of other registered practitioners, 4.
9. Schools :—
   (a) Number of Government and State-aided schools, 83.
   (b) Number of scholars registered in these schools, 8,123.
   (c) Percentage of daily attendances, 66·19.
10. Estate employing indentured labour : Nil.
11. Estimated Revenue of Colony :—
    Total during year, £353,148.
12. Estimated expenditure of Colony :—
    (a) Total during year, £356,964.
    (b) Annual medical and sanitary expenditure, £23,488.
    (c) Upkeep of Government hospitals and dispensaries, £5,697.
    (d) Total salaries and allowances of Medical Officers, £8,856.
    (e) Total annual sanitary expenditure, £3,529.
13. Towns under municipalities or town councils :—
    (a) Number of such, 1.
    (b) Total population, 34,010.
    (c) Total revenues, £11,500.
    (d) Total medical and sanitary expenditure, £2,605.

* No. 11 in Appendix I. in [Cd. 5514). February, 1911.

14. Table of deaths by districts: Not known.

15. Table of deaths in the principal towns:—

Town: Freetown.
District where situated: Colony.
Population of town: 34,010.
Total deaths:—

January	87
February	63
March	80
April	74
May	63
June	62
July	102
August	91
September	82
October	93
November	82
December	57
Total	936

16. Rainfall during the year:—

Where observed: Freetown.
District: Colony.
Rainfall:—

	Inches.
January	Nil.
February	·48
March	·28
April	·51
May	9·17
June	7·62
July	43·24
August	40·51
September	19·80
October	8·86
November	2·29
December	·62
Total	133·44

17. Additional information to be given if possible on the following points:—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Number of notices, convictions and warnings during the year?

Yes. The Public Health Ordinance, 1905, and Public Health Amendment Ordinance, 1910. The latter was passed to strengthen the hands of the authorities. The presence of larvæ in premises being held to be a nuisance liable to be dealt with summarily.

Notices served under Public Health Ordinance, 3,477.
Number of summonses, 169.
Number of convictions, 136.

(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected? Does Kala-azar exist?

Total number of children examined for enlarged spleen, 1,451. Percentage affected, 17·5.

Children were examined at: Freetown, Waterloo, York, Kent, Bananas, Tombo.

Kala-azar is not known to exist.

(*c*) Number of persons examined for filarial diseases? Where was this done? Percentage affected?

None.

(*d*) Any large works for surface drainage of towns or reclamation of marshes? Approximate cost?

None to my knowledge.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works? Approximate cost?

I have endeavoured to obtain this information, but without success.

(*f*) Amount of Government quinine sold or distributed gratis during the year? Agencies employed?

102 lbs. 12 ozs. quinine have been distributed during the year in hospitals and dispensaries.

(*g*) Is quinine distributed regularly in schools?

No.

(*h*) Measures taken against these diseases in estates employing indentured labour?

There are no estates or indentured labour.

(*i*) Any steps taken regarding the housing of the poor?

None.

(*j*) Any exceptional increase or decrease of these diseases recently noticed?

There was an increase in yellow fever in 1910

(*k*) Any other remarks on the subject. None.

No. 7.

SIERRA LEONE.

The ACTING GOVERNOR to the SECRETARY OF STATE.

(Received October 7, 1912.)

Sir, Government House, Sierra Leone, 21st September, 1912.

I have the honour to acknowledge the receipt of your Circular despatch of the 27th February last,* and to inform you that, in compliance with your instructions, I forwarded to the Principal Medical Officer, for distribution to the Medical Officers in his Department, copies of the Report of the Advisory Committee for the Tropical Diseases Research Fund for the year 1911, which were transmitted with your despatch under reply.

2. With reference to paragraph 2, Dr. Forde has informed me that no member of the West African Medical Staff has any special observations to make on the report. He has, however, submitted some remarks on anti-malarial work in Freetown during 1911, and a return of malarial fever, blackwater fever, &c., which I now forward for the information of the Advisory Committee.

I have, &c.,

G. B. HADDON SMITH,

Acting Governor.

Enclosure in No. 7.

Anti-Malarial Work in Freetown during 1911, and some of the Results thereof.

In Freetown, the chief town of Sierra Leone, during 1911 there was a satisfactory falling off in the number of fever cases, and both the general and the infantile death-rates were the lowest yet recorded.

General death-rate, 21 per 1,000 of population.

Infantile death-rate, 310 per 1,000 of births.

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* Not printed; it forwarded copies of the Report of the Advisory Committee for 1911 [Cd. 6024].

The former is 6 per 1,000 less than in 1910; and the latter 58 per 1,000 less than in 1910. There were 151 fever cases of malarial fever recorded by Medical Officers at the Colonial Hospital, and among the general deaths registered there were 54 fewer deaths caused by fever. These results are, in my opinion, directly due to the rigorous enforcement of the anti-mosquito laws passed by the Government during 1910 and 1911, effecting thereby a reduction of larvæ-bearing compounds of from 30 to 40 per cent. in [the] early part of 1910 to 6 per cent. at the close of 1911. The sanitation of Freetown was carried on as usual by the Sanitary Department of the Town Council, for which there was estimated the sum of £2,605 16s. 3d. Of this amount, £459 12s. 11d. represents the pay of a Sanitary Inspector and 14 Assistant Inspectors, and £1,200 the actual cost of scavenging as done by the Council. It was found, however, as in the previous year, that a larger gang of labourers was required for scavenging, as the 50 to 100 men for which the Corporation provided were found quite inadequate to cope with the seemingly inexhaustible amount of waste matter collected in the town, especially old tins, bottles, &c. Therefore, the Government had to provide an extra 100 men in order to comply with the exigencies of the case.

2. The following list shows some of the work done by the Sanitary Inspectors during the year :—

Summonses taken out for presence of mosquito larvæ, &c., 1,313.
Number of convictions, 1,029.
Amount received in fines, £240 6s. 7d.
Number of notices served for insanitary conditions, 1,336.
Number of canoe loads of old tins, bottles, &c., removed and dumped into the sea, 1,514.
Number of cart loads of rubbish removed and burnt in incinerators, 3,046.

The quantity of old tins, bottles, and other waste articles likely to act as mosquito breeders removed—a canoe's capacity by measurement being two tons—was 3,028 tons as compared with 2,042 tons in 1910.

Other anti-malarial measures, such as the oiling of pools, the clearing of drains, and the free administration of quinine were continued during the year.

Report of Malarial Fever, Blackwater Fever, Yellow Fever, Filariasis, and Dengue during the Year 1911.

1. Name of Colony : Sierra Leone.
2. Total area : 30,000 square miles (Colony and Protectorate).
3. Estimated population :—
   (*a*) Total, 75,572 (Colony); about 1,000,000 (Protectorate).
   (*b*) Europeans, 702.
   (*c*)
   (*d*) Other races, Asiatics, 202.
   (*e*)
4. Births during the year :—
   Total births, 1,116 (Colony).
5. Deaths during the year :—
   (*a*) Total deaths, 1,314.
   (*b*) Deaths ascribed to fever, 68 (Freetown).
   (*c*) Deaths ascribed to blackwater fever, 5.
   (*d*) Deaths ascribed to yellow fever, nil.
6. Government Hospitals :—
   (*a*) Number of such hospitals, 11.
   (*b*) Totals during year :—Admissions, 2,570; deaths, 229.
   (*c*) Malarial fever :—Admissions, 137 (Colony and Protectorate Stations); deaths, 2 (Colony and Protectorate Stations).
   (*d*) Blackwater fever :—Admissions, 7; deaths, 5.
   (*e*) Yellow fever :—Admissions, nil; deaths, nil.
   (*f*) Filarial diseases :—Admissions, 16; deaths, 3.
   (*g*) Dengue :—Admissions, nil; deaths, nil.
7. Government Dispensaries :—
   (*a*) Number of such dispensaries, 21.
   (*b*) Total attendances during year, 83,103.

(*c*) Attendances for malaria, 2,281.
(*d*) Attendances for filarial diseases, 17.
(*e*) Attendances for dengue, nil.

8. Medical service :—
(*a*) Number of Government Medical Officers, 18.
(*b*) Number of Special Health Officers, 3.
(*c*) Number of other registered practitioners, 4.

9. Schools :—
(*a*) Number of Government and State-aided schools, 91.
(*b*) Number of scholars registered in these schools, 8,134
(*c*) Percentage of daily attendances, 62·2.

10. Estate employed indentured labour :—
(*a*) Number of such, nil.
(*b*) Number of indentured labourers employed, nil.
(*c*) Number of hospitals and dispensaries on such estates, nil.
(*d*) Total deaths among such labourers, nil
(*e*) Deaths ascribed to malaria, nil.
(*f*) Total admissions and attendances at hospitals and dispensaries, nil.

11. Estimated revenue of Colony :—
(*a*) Total during year, £426,246.

12. Estimated expenditure of Colony :—
(*a*) Total during year, £525,914.
(*b*) Annual medical and sanitary expenditure, £29,137.
(*c*) Upkeep of Government hospitals and dispensaries, £6,328.
(*d*) Total salaries and allowances of Medical Officers, £10,657.
(*e*) Total annual sanitary expenditure £3,089, exclusive of minor improvements by the Public Works Department.

13. Towns under municipalities or town councils :—
(*a*) Number of such, 1.
(*b*) Total population, 34,090.
(*c*) Total revenues, £8,827 8s. 7d., including a Government grant-in-aid of £1,800.
(*d*) Total medical and sanitary expenditure, £2,335 17s. 9d.

14. Table of deaths by districts :—

District.	Area.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Not known.															

15. Table of deaths in the principal towns :—

Town.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Freetown ...	Colony ...	34,090	66	53	52	60	50	63	78	70	70	59	57	69	747

16. Rainfall during the year :—

Where Observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Freetown ...	Freetown ...	·01	·07	·02	·66	4·00	15·52	26·05	36·08	33·04	14·23	6·00	·91	136·59 inches

17. Additional information to be given if possible on the following points :—
  (*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Number of notices, convictions, and warnings during the year.—Notices for mosquito larvæ, 1,350. Number of convictions for mosquito larvæ, 1,054. Daily warnings at house to house inspections.
  (*b*) Number of children examined for enlarged spleen. When was this done? Percentage affected. Does kala-azar exist?—1,149 children examined in Freetown schools; 16·1 per cent. affected. 302 children examined in Colony villages; 22·5 per cent. affected. Kala-azar not known to exist.
  (*c*) Number of persons examined for filarial diseases. Where was this done? Percentage affected.—Nil.
  (*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost.—First stages in construction of intercepting drain (Brookfields, Freetown), £600.
  (*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.—Freetown (Government and Corporation), average 150 men daily. Sherbro (Health Board), 12 men daily. Cost about £2,000.
  (*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed.—Gratis-Government dispensaries, Freetown, Kissy, Hastings, Wellington, Waterloo, Regent, Kent, &c., &c., and all Government stations. Princess Christian Mission Hospital, Freetown.
  (*g*) Is quinine distributed regularly in the schools?—In some schools.
  (*h*) Measures taken against these diseases in estates employing indentured labour.—No estates.
  (*i*) Any steps taken regarding the housing of the poor.—Two hospitals for destitute incurables.
  (*j*) Any exceptional increase or decrease of these diseases recently noticed.—No.
  (*k*) Any other remarks on the subject.—Nil.

R. M. FORDE,
Principal Medical Officer.

Colonial Medical Department,
Freetown, Sierra Leone,
17th September, 1912.

No. 8.

SOUTHERN NIGERIA.

RETURN OF MALARIA FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE, DURING THE YEAR FROM THE 1ST JANUARY TO THE 31ST DECEMBER, 1911.

(Received in Colonial Office, July 23, 1912.)

1. Name of Colony.—Southern Nigeria.
2. Total area.—79,880 square miles.
3. Estimated population.—7,857,983.
  (*a*) Total natives—7,855,749.
  (*b*) Europeans—1,648.
  (*c*) Asiatics—99.
  (*d*) Other races—nil.
  (*e*) Other non-West African natives—487.
4. Births during the year :—
  Lagos and Ebute Metta, 2,718.
5. Deaths during the year :—
  (*a*) Total deaths.—Not ascertainable.
  (*b*) Deaths ascribed to fever, Lagos and Ebute Metta.—353.
  (*c*) Deaths ascribed to blackwater fever.—8.
  (*d*) Deaths ascribed to yellow fever.—None.
6. Government hospitals :—
  (*a*) Number of such hospitals, 21.
  (*b*) Totals during year :—

Admissions	5,591
Deaths	328

(*c*) Malarial fever :—
Admissions 712
Deaths 13

(*d*) Blackwater fever :—
Admissions 17
Deaths 8

(*e*) Yellow fever, nil.

(*f*) Filarial diseases :—
Admissions 73
Deaths ... ... —

(*g*) Dengue.—Nil.

7. Government dispensaries :—
(*a*) Number of such dispensaries.—41.
(*b*) Total attendances during year.—369,037.
(*c*) Attendances for malaria
(*d*) Attendances for filarial diseases } No special return for special diseases.
(*e*) Attendances for dengue.—Nil.

8. Medical service :—
(*a*) Number of Government medical officers—73.
(*b*) Number of special health officers—3.
(*c*) Number of other registered practitioners—15.

9. Schools :—
(*a*) Number of Government and State-aided schools—176.
(*b*) Number of scholars registered in these schools—19,853.
(*c*) Percentage of daily attendances—70·5 per cent.

10. Estates employing indentured labour.—None.

11. Estimated revenue of Colony :—
Total during year.—£1,727,196.

12. Estimated expenditure of Colony :—
(*a*) Total during year—£1,774,364.
(*b*) Annual medical and sanitary expenditure—£79,698.
(*c*) Upkeep of Government hospitals and dispensaries—£12,069.
(*d*) Total salaries and allowances of medical officers—£61,199.
(*e*) Total annual sanitary expenditure—£27,845.

13. Towns under municipalities or town councils :—
(*a*) Number of such : 1—Lagos, including Ebute Metta and Apapa.
(*b*) Total population—73,766.
(*c*) Total revenues—£22,801.
(*d*) Total medical and sanitary expenditure—£20,779.

14. Table of Deaths by Districts :—Not known.
District :—Western Province. Area : 28,600 square miles. Population : 2,152,776.
District :—Central Province. Area : 22,670 square miles. Population : 2,408,118.
District :—Eastern Province. Area : 28,610 square miles. Population : 3,297,089.
Total :—Area : 79,880 square miles. Population : 7,857,983.

15. Table of Deaths in the Principal Towns :—

Town.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Lagos ...	Western Province.	73,766	157	127	158	125	115	172	198	191	148	178	146	158	1,873
Ebute Metta.			21	32	29	28	36	23	29	30	23	27	19	20	317
Total	...	73,766	178	159	187	153	151	195	227	221	171	205	165	178	2,190

16. Rainfall during the year :—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Lagos ...	Western Province	4·57	·29	11·26	7·87	21·12	25·35	1·39	·30	2·94	7·98	·32	3·69	87·08
Warri ...	Central Province	15·45	·46	8·52	15·32	14·07	12·92	20·50	4·89	17·52	16·75	4·00	Nil.	130·40
Calabar ...	Eastern Province	1·26	1·38	3·28	7·10	15·96	18·47	18·68	25·79	14·30	14·41	3·69	·55	124·87
Total ...	... ...	21·28	2·13	23·06	30·29	51·15	56·74	40·57	30·98	34·76	39·14	8·01	4·24	342·35

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitos in premises ?—The Destruction of Mosquitos Ordinance, 1910.
Numbers of notices and warnings during the year : None.
Numbers of convictions during the year, 830.

(*b*) Number of children examined for enlarged spleen. Where was this done ? Percentage affected.—656 children. Central Province, 65·8 per cent.
Does Kala-azar exist ?—No.

(*c*) Number of persons examined for filarial diseases. Where this was done ? Percentage affected.—Only patients attending hospital for filaria examined. ·5 per cent.

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost.—£8,127.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.—163 men. Cost, £1,500.

(*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed.—2,346,447 grains. By medical officers and dispensers.

(*g*) Is quinine distributed regularly in the schools ?—Not regularly.

(*h*) Measures taken against these diseases on estates employing indentured labour.—No such estate.

(*i*) Any steps taken regarding the housing of the poor.—None.

(*j*) Any exceptional increase or decrease of these diseases recently noticed.—No marked change.

ARTHUR PICKELS,
Acting Principal Medical Officer.

No. 9.

ZANZIBAR.

Mr. CLARKE (Zanzibar) to Sir EDWARD GREY.

(Received September 3, 1912.)

Sir, Zanzibar, August 9, 1912.

I have the honour to transmit to you herewith copy of a letter from the Health Officer to the First Minister, covering a report for the year 1911, on the prevention of mosquito-borne diseases in the Zanzibar protectorate.

I desire to make the following observations :—

4. *Births.*—The registration of births is compulsory under the Registration of Births Decree, No. 13, of 1909. Owing, however, to the difficulty experienced in carrying out its provisions effectively, it is possible that a certain number of births, which cannot be estimated, may have been concealed.

5. *Deaths.*—The registration of deaths is compulsory under Chapter XXI. of the Consolidation of Laws Decree, No. 7, of 1909. The strictest supervision is

exercised by the Public Health Department in conjunction with the police, and the figures given may be accepted as being reliable.

8. *Medical Service.*—The number of Government medical officers has recently been increased to five.

9. *Schools.*—The schools referred to in the report are under the direct control of the Government; there are no State-aided schools in the protectorate.

In addition to these, however, there are a number of Indian and mission schools and Arab Koran classes. No statistics are available in regard to them.

17. (*f*) and (*g*).—It is contemplated to introduce in the course of next year a system of quinine distribution both to the native public in general and in Government and private schools.

I have, &c.,
EDWARD CLARKE.

Enclosure 1 in No. 9.

HEALTH OFFICER to ACTING FIRST MINISTER.

SIR, Zanzibar, July 27, 1912.

I HAVE the honour to forward to you a report for the year 1911 on the prevention of mosquito-borne diseases, drawn up on the lines suggested by Sir Ronald Ross. I should be glad if you would forward this report to the Secretary of the Advisory Committee for Tropical Diseases.

From this report it will be seen that the mosquito-borne diseases are responsible for 25 per cent. of the total admissions to hospitals and for 9 per cent. of the total attendances at dispensaries.

The work of prevention of malaria and other mosquito-borne diseases progresses.

A mosquito brigade works actively in the town, whilst out in the districts the vaccinators and dispensers are held responsible for doing all they can to help reduce the number of these insects. Besides this, considerable work on the drainage of swamps is being undertaken by the Government.

I am indebted to Dr. MacDonald, Principal Medical Officer, Zanzibar Government, for supplying me with figures taken from his records, and to Dr. Howard, of the Universities' Mission Hospital, and to Dr. Albuquerque, of the Khoja Dispensary, for sending me their returns.

I have, &c.,
D. S. SKELTON, Captain,
Royal Army Medical Corps.

Enclosure 2 in No. 9.

REPORT on Mosquito-Borne Diseases for January 1 to December 31, 1911.

1. Name of Protectorate, Zanzibar (including Pemba).

2. Total area of both islands, 1,020 square miles.

3. Estimated population :—

(*a*) Total ...	197,199
(*b*) Europeans ...	234
(*c*) Indians and Cingalese ...	8,305
(*d*) Other races ...	188,660

4. Births during the year :—

Total births ...	2,344

5. Deaths during the year :—

(*a*) Total deaths ...	4,881
(*b*) Deaths ascribed to fever ...	190
(*c*) Deaths ascribed to blackwater fever ...	9
(*d*) Deaths ascribed to yellow fever ...	Nil

6. Hospitals:—

Particulars.	Government Hospitals.	Other Hospital (U.M.C.A.).	Total.
(*a*) Number of hospitals	2	1	3
(*b*) Total during year:—			
Admissions	1,586	285	1,871
Deaths	78	7	85
(*c*) Malarial fever:—			
Admissions	346	55	401
Deaths	6	—	6
(*d*) Blackwater fever:—			
Admissions	3	1	4
Deaths	2	1	3
(*e*) Yellow fever:—			
Admissions ... ... } Deaths	—	—	—
(*f*) Filarial diseases:—			
Admissions	37	25	62
Deaths	1	—	1
(*g*) Dengue:—			
Admissions	—	6	6
Deaths	—	—	—

7. Dispensaries:—

Particulars.	Government Dispensaries.	Other Dispensaries (Khoja and U.M.C.A.).	Total.
(*a*) Number of dispensaries ...	6	2	8
(*b*) Total attendance during the year.	21,091	33,589	54,680
(*c*) Attendance for malaria ...	1,318	3,818	5,136
(*d*) Attendance for filarial diseases	119	88	207
(*e*) Attendance for dengue ...	—	—	—

8. Medical service:—

(*a*) Number of Government medical officers 4*
(*b*) Number of special health officers 2
(*c*) Number of other registered practitioners 5

9. Schools:—

(*a*) Number of Government and State-aided schools ... 7
(*b*) Number of scholars registered in these schools ... 350
(*c*) Percentage of daily attendances ... ... 72·2 per cent.

10. There are no estates employing indentured labour.

11. Estimated revenue of Protectorate:—
Total during year £237,422

12. Estimated expenditure of Protectorate:—

	£
(*a*) Total during year	207,950
(*b*) Annual medical and sanitary expenditure ...	17,998
(*c*) Upkeep of Government Hospitals and dispensaries	8,771†
(*d*) Total salaries and allowances of medical officers ...	2,528‡
(*e*) Total annual sanitary expenditure	9,227

13. No towns under municipalities.

* One of these medical officers is always on leave.
† This includes cost of upkeep of leper settlement.
‡ In addition to this sum the Protectorate of British East Africa contributes £100 a year towards Health Officer's salary for quarantine work.

14. Table of deaths by districts :—

Districts.	No. of Deaths.	Total.
Island of Zanzibar :—		
Zanzibar Town	1,373	
Mkokotoni	1,258	
Chwaka	457	
Mwera	739	
		3,827
Island of Pemba		
Chake-Chake	398	
Weti	464	
M'Koani	192	
		1,054
Total for both Islands	—	4,881

15. Table of deaths in principal towns. (*See* No. 14.)

16. Rainfall during the year :—

January	0·54
February	0·01
March	9·92
April	13·40
May	17·52
June	2·24
July	1·53
August	1·76
September	1·22
October	2·89
November	6·26
December	1·86
Total	59·14

Average, 77·03.

17. Additional information to be given, if possible, on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises ?—Yes. Under the Public Health Decree, " any collection of water in any well, pool, channel, barrel, tub, bucket, or any other vessel and found by the Health Officer to contain mosquito larvæ shall be nuisances liable to be dealt with under this decree."

Number of notices during the year, 63.
Number of convictions, none.
Number of warnings, 700.

(*b*) Number of persons of the age of 15 examined for enlarged spleen, 400.

Where was this done ?—At the schools and villages.
Percentage affected, 12·25 per cent.
Does Kala-azar exist ?—No.

(*c*) Number of persons examined for filarial diseases, none.

Where was this done ?—
Percentage affected ?—Nil.

(*d*) Large works for surface drainage of towns and reclamation of swamps. 10,000 rupees were spent on drainage work for the swamps near Zanzibar town.

(*e*) Numbers of men employed in town for petty anti-mosquito work. In Zanzibar town three trained men are employed as inspectors. Approximate cost 960 rupees per annum. In Pemba the Sanitary Inspector goes round once in a week.

(*f*) Amount of Government quinine sold or distributed gratis during the year. There is no free distribution of quinine except to the King's African Rifles and the Zanzibar armed constabulary at Ziwani and to the prisoners and Government employés at Chake-Chake in Pemba.

(*g*) Is quinine regularly distributed in the schools?—No.

(*h*) Not applicable. There is no indentured labour.

(*i*) Housing of the poor. No special steps.

(*j*) Increase or decrease in the diseases noted.—The death-rate from malaria is practically stationary.

D. S. Skelton, Captain.

No. 10.

JAMAICA.

RETURN OF MALARIAL FEVER, &c., DURING THE YEAR FROM 1ST JANUARY TO 31ST DECEMBER, 1910.

(Received in Colonial Office, 26 February, 1912.)

1. Name of Colony, Jamaica.

2. Total area, 4,207 square miles.

3. *Estimated population on 1st April, 1911:—*

(*a*) Total, 831,383 (Census 1911).
(*b*) Europeans, not known.
(*c*) Whites, 15,605.
(*d*) Other races, 815,778.
(*e*)

4. *Births during the year:—*

Total births, 31,570.

5. *Deaths during the year:—*

(*a*) Total deaths, 18,804.
(*b*) Deaths ascribed to fever, 3,136.
(*c*) Deaths ascribed to blackwater fever, 1.
(*d*) Deaths ascribed to yellow fever, nil.

6. *Government hospitals:—*

(*a*) Number of such hospitals, 20, one of which is a lying-in hospital.

(*b*) Totals during year:—

Admissions 21,689
Deaths 419

(*c*) Malarial fever:—

Admissions 6,371
Deaths 58

(*d*) Blackwater fever:—

Admissions 1
Deaths 0

(*e*) Yellow fever:—

Admissions 0
Deaths 0

(*f*) Filarial fever:—

Admissions 7
Deaths 0

(*g*) Dengue:—

Admissions 0
Deaths 0

7. *Government dispensaries:*—
(*a*) Number of such dispensaries, none.
(*b*) Total attendances during year, none.
(*c*) Attendances for malaria, none.
(*d*) Attendances for filarial diseases, none.
(*e*) Attendances for dengue, none.

8. *Medical service:*—
(*a*) Number of Government Medical Officers, 50.
(*b*) Number of Special Health Officers, 10.
(*c*) Number of other registered practitioners, 57.

9. *Schools:*—
(*a*) Number of Government and State-aided schools, 693.
(*b*) Number of scholars registered in these schools, 89,902.
(*c*) Percentage of daily attendances, 64·34.

10. *Estates employing indentured labour:*—
(*a*) Number of such, 66.
(*b*) Number of indentured labourers employed, 3,749.
(*c*) Number of hospitals and dispensaries on such estates, none; cases are treated at public general hospitals.
(*d*) Total deaths among such labourers, 72.
(*e*) Deaths ascribed to malaria, 17.
(*f*) Total admissions and attendances at hospitals and dispensaries, 19,797.

11. *Estimated revenue of Colony:*—
(*a*) Total during year to 31st March, 1911, £951,267.

12. *Estimated expenditure of Colony:*—
(*a*) Total during year to 31st March, 1911, £993,160.
*(*b*) Annual medical expenditure, Medical Department, inclusive of lunatic and leper asylums, £64,265.
(*c*) Upkeep of Government hospitals and dispensaries, £15,418.
(*d*) Total salaries and allowances of Medical Officers, £7,841.
(*e*) Total annual sanitary expenditure by parishes, exclusive of Kingston, £5,493.

13. *Towns under municipalities or town councils:*—
(*a*) Number of such, Kingston only.
(*b*) Total population, 59,592.
(*c*) Total estimated revenue, £33,378.
(*d*) Total estimated sanitary expenditure by City Council, £6,532.
By Kingston General Commissioners, £3,410.
Debt charges, £6,544.

14. *Table of deaths by parishes:*—

Parish.	Area. Square Miles.	Estimated Population (mean).	Total Deaths during the Year 1910.				
			March Quarter.	June Quarter.	September Quarter.	December Quarter.	Total.
Kingston	7 1/6	59,592	652	578	414	401	2,045
St. Andrew	166	52,642	482	336	312	340	1,470
St. Thomas	274	39,019	260	203	180	271	914
Portland	285	48,819	286	225	243	329	1,083
St. Mary	249	72,289	407	316	328	430	1,481
St. Ann	476	69,426	321	244	282	327	1,174
Trelawny	333	35,116	236	185	171	212	804
St. James	234	40,942	236	224	212	203	875
Hanover	167	37,015	225	218	222	208	873
Westmoreland ...	308	65,772	367	297	384	394	1,442
St. Elizabeth ...	462	77,533	461	311	332	439	1,543
Manchester	302	64,254	290	201	275	327	1,093
Clarendon	474	73,341	546	359	364	445	1,714
St. Catherine ...	470	87,493	633	504	518	638	2,293
Total	4,207 1/6	823,253	5,402	4,201	4,237	4,964	18,804

* This does not include medicines, &c., for paupers, which is paid by the parishes.

15. *Table of deaths in principal towns:—*

Town.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Kingston	Kingston	57,275 (estimated mean).	233	182	233	205	179	185	138	160	111	133	106	154	2,019

NOTE.—The Registrar-General explains that this information can be furnished in respect of Kingston only.

16. *Rainfall during the year* 1910*:—*

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Returns from about 200 average stations.	North East.	11·64	4·66	8·63	3·29	3·34	7·89	5·46	9·57	10·12	18·58	13·63	22·26	119·07
	North...	4·75	2·40	2·89	2·36	2·36	3·07	3·53	4·87	5·33	11·29	6·77	14·63	64·25
	West Central.	2·18	1·34	3·88	6·49	10·76	8·15	8·48	9·87	13·48	15·08	5·83	7·54	93·08
	South...	2·58	0·40	2·39	2·17	4·45	3·83	4·80	5·76	5·91	14·00	4·22	4·15	54·66
Total	...	5·29	2·20	4·45	3·50	5·23	5·74	5·57	7·52	8·71	14·74	7·61	12·14	82·76

17.—(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Numbers of notices, convictions and warnings during the year?—Yes. Section 7, Law 35, of 1910. By-laws in relation to this Law have been framed but not so far accepted by Parochial Boards.

(*b*) Number of children examined for enlarged spleen? Where was this done? Percentage affected? Does kala-azar exist?—An endemic index for malaria estimated by examination of school children for enlarged spleen and microscopic examination of blood for malarial parasites is attached. Kala-azar does not exist here.

(*c*) Number of persons examined for filarial diseases? Where was this done? Percentage affected?—No examination has been made.

(*d*) Any large works for surface drainage of towns or reclamation of marshes? Approximate cost during the year?—Surface drainage of Smith's Village and reclamation of marsh by deposit of city refuse. Approximate cost, £2,378. Port Antonio surface drainage and marsh reclamation by private owners. Montego Bay, St. Ann's Bay surface drainage. Other small works by grants from the Malaria Commission (*see* Report).

(*e*) Number of men employed in towns and villages for petty anti-mosquito works? Approximate cost?—None, exclusively, but Inspectors of Nuisances are employed in all towns and large villages.

(*f*) Amount of Government quinine sold or distributed gratis during the year—agencies employed?—Sulphate of quinine (pure), 3,480 ounces. Quinine tablets, 396 lbs. The agencies employed are public hospitals, Parochial Boards, Malaria Commission, Post Offices, Police Stations, estates.

(*g*) Is quinine distributed regularly in the schools?—Up to 27th January, 1911, 225 schools out of 697 on the Government grant list had received quinine. From July to December, 1910, 125 lbs. were distributed.

(*h*) Measures taken against these diseases on estates employing indentured labour?—Administration of quinine.

(*i*) Any steps taken regarding the housing of the poor?—Poor houses in every parish with one exception, annual expenditure on poor relief of £52,000.

(*j*) Any exceptional increase or decrease of these diseases recently noticed? —No.

(*k*) Any other remarks on the subject?—Malaria is very prevalent among new batches of coolies in the Island, and the large number of admissions to certain hospitals is due to this fact. Ankylostomiasis is also very prevalent among the coolie immigrants.

Statistics regarding Malaria amongst the troops serving in Jamaica during the years 1908-1909-1910.

European troops.

Year.	Average Strength.	Deaths from all Diseases.	Deaths from Malaria.	Remarks.
1908	444	3	—	Admissions due to diseases contracted at Port Nugent, chiefly.
1909	412	7	2	
1910	378	2	1	
Non-European troops.				
1908	680	4	—	
1909	591	2	—	
1910	583	2	—	

Number of cases of malaria and ratio per 1,000 by stations.

Europeans.

Year.	Up Park Camp.		Port Royal.		Newcastle.	
	Number of Cases.	Ratio per 1,000.	Number of Cases.	Ratio per 1,000.	Number of Cases.	Ratio per 1,000.
1908	26	166·66	8	34·19	2	55·55
1909	24	192·00	47	191·84	—	—
1910	6	61·86	43	182 98	5	108·70
Non-European.						
1908	204	306·31	—	—	—	—
1909	59	100·17	3	150·00	—	—
1910	36	61·96	—	—	—	—

Increase due to operations at Fort Nugent; increase due to operations at Ferry.

Endemic Index for Malaria.

	per cent.
Falmouth	13·1
Spanish Town	16·7
Linstead	21·5
Buff Bay	32·0
Sav-la-mar	34·0
Montego Bay	35·0
Port Maria	36·0
Lucea	37·6
St. Ann's Bay	37·9
Annotto Bay	45·
Black River	45·

No. 11.

JAMAICA (Cayman Islands).

RETURN OF MALARIA FEVER, BLACKWATER FEVER, YELLOW FEVER, AND FILARIASIS FROM JANUARY 1 TO DECEMBER 31, 1911.

(Received in Colonial Office April 13, 1912.)

1. Name of Colony, Cayman Islands.
2. Total area, 61,000 acres.
3. Estimated population :—
   White (Europeans or of European descent), 2,322.
   Coloured, 2,211.
   Black, 1,031.
4. Births during the year, 236.
5. Deaths during the year, 78.
   None ascribed to malaria, blackwater, or yellow fever.
6. Government hospitals, none.
7. Government dispensaries, none.
8. Number of Government Medical Officers, 2.
   No special Health Officers or other registered practitioners.
9. Number of—
   (*a*) Government schools, 4.
   State-aided schools, none.
   (*b*) Scholars registered in these schools, 505.
   (*c*) Percentage of daily attendance, 88.
10. Estates employing indentured labour, none.
11. Estimated revenue of Colony, £2,740.
12. Estimated expenditure :—
   (*a*) Total during year, £2,678 9s. 0d.
   (*b*) Annual medical and sanitary expenditure, £210.
   (*c*) Upkeep of Government hospitals and dispensaries, nil.
   (*d*) Total salaries and allowances of Medical Officers, £250.
   (*e*) Total annual sanitary expenditure, nil.
13. Towns under municipalities or town councils, none.

District.	Area.	Population.	Total Deaths.			
			Quarter ending March 31st, 1911.	Quarter ending June 30th, 1911.	Quarter ending September 30th, 1911.	Quarter ending December 31st 1911.
Georgetown and West Bay	—	2,411	4	5	2	Nil
Prospect and S.W. Sound ...	—	346	1	2	Nil	Nil
Boddentown	—	625	2	4	Nil	4
East End and Northside ...	—	746	1	1	3	2
Total	—	—	8	12	5	6

Rainfall during the year.

District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Georgetown	2·96	·23	·40	·99	12·49	10·56	2·29	3 49	7·21	6·01	11·59	4·39
Boddentown	3·17	·72	Nil	1·38	7 85	8·04	·80	2·39	3·61	1·76	7·51	3·06
East End	3·22	·16	·11	1·31	4·83	7·35	2·14	1·29	3·36	1·56	8·39	1·81

17. (*a*) No.
   (*b*) None.
   (*c*) None

(*d*) One large marsh has been drained at a cost of about £10 and another is about to be drained at an estimated cost of £30. Other marshes will be drained as funds become available.
(*e*) None.
(*f*) None.
(*g*) No.
(*h*) No estates employing indentured labour.
(*i*) There are no poor requiring housing.
(*j*) No.
(*k*) Malarial fever is not endemic in the Cayman Islands. The only cases coming under observation are imported from the Panama Canal and other Central American districts. These cases, as a rule, recover completely in a few weeks. In cases where anæmia is very pronounced recovery takes place in about two months. I notice all the cases of pronounced anæmia come from the Panama Canal zone. It might be mentioned that the ordinary imported case of malarial fever recovers without treatment.

GEORGE S. S. HIRST.

No. 11A.

JAMAICA.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1st JANUARY TO THE 31st DECEMBER, 1911.

(Received in Colonial Office, 25 November, 1912.)

1 Name of Colony, Jamaica.
2. Total area, 4,450 square miles.
3. Estimated population on 1st April, 1912, 845,502.
(*a*) Total, 831,383 (Census, 1911).
(*b*) White, 15,605.
(*c*) Coloured, 163,201.
(*d*) Black, 630,181.
(*e*) Other races, 22,396.
4. Births during the year :—
Total births, 33,175.
5. Deaths during the year :—
(*a*) Total deaths, 19,339.
(*b*) Deaths ascribed to fever, 2,845.
(*c*) Deaths ascribed to blackwater fever, 2.
(*d*) Deaths ascribed to yellow fever, nil.
6. Government hospitals :—
(*a*) Number of such hospitals, 20 (one of which is a lying-in hospital).
(*b*) Totals during year :—

	Admissions	24,163
	Deaths	505
(*c*) Malarial fever :—		
	Admissions	7,364
	Deaths	62
(*e*) Yellow fever :—		
	Admissions	3
	Deaths	Nil.
(*f*) Filarial diseases :—		
	Admissions	21
	Deaths	1
(*g*) Dengue :—		
	Admissions	2
	Deaths	Nil.

7. Government dispensaries :—
(*a*) Number of such dispensaries.
(*b*) Total attendances during year.
(*c*) Attendances for malaria.
(*d*) Attendances for filarial diseases.
(*e*) Attendances for dengue.
} There are no Government dispensaries.

8. Medical service :—
 (*a*) Number of Government Medical Officers, 52.
 (*b*) Number of special Health Officers, 25.
 (*c*) Number of other registered practitioners, 58.

9. Schools :—
 (*a*) Number of Government and State-aided schools, 698.
 (*b*) Number of scholars registered in these schools, 94,923.
 (*c*) Percentage of daily attendance, 62·4.

10. Estates employing indentured labour :—
 (*a*) Number of such, 69.
 (*b*) Number of indentured labourers employed, 2,842.
 (*c*) Number of hospitals and dispensaries on such estates, nil. There are 9 public general hospitals and 4 dispensaries where indentured immigrants are treated.
 (*d*) Total deaths among such labourers, 89.
 (*e*) Deaths ascribed to malaria, 13.
 (*f*) Total admissions and attendance at hospitals and dispensaries, 22,936.

11. Estimated revenue of Colony :—
 Total during year ending 31st March, 1912, £989,361.

12. Estimated expenditure of Colony :—
 (*a*) Total during year ending 31st March, 1912, £1,003,934.
 (*b*) Annual medical and sanitary expenditure : Medical department, £70,526; Malaria Commission, £2,000.
 (*c*) Upkeep of Government hospitals, £17,000
 (*d*) Total salaries and allowances of medical officers, £10,981.
 (*e*) Total annual sanitary expenditure by parishes, exclusive of Kingston, £5,988.

13. Towns under municipalities or town councils :—
 (*a*) Number of such, one—Kingston.
 (*b*) Total population, 60,194.
 (*c*) Total revenues, £33,441.
 (*d*) Total medical and sanitary expenditure :—By City Council, £6,153. By Kingston General Commissioners, inclusive of sewers and pumping station, £3,510.* Debt charges, £6,544.

14. Table of deaths by parishes :—

Parish.	Area. Square Miles.	Total Deaths during the year 1911.					
		Estimated Population (mean).	March Quarter.	June Quarter.	September Quarter.	December Quarter.	Total.
Kingston	7¾	59,810	533	449	381	359	1,722
St. Andrew	183	52,963	462	385	287	302	1,436
St. Thomas	298½	39,551	311	243	225	247	1,026
Portland	338	49,606	316	273	283	297	1,169
St. Mary	251	73,329	497	345	344	373	1,559
St. Ann	487	71,116	450	297	376	317	1,440
Trelawny	353	35,590	253	238	217	216	924
St. James	239½	41,569	272	227	245	190	934
Hanover	177	37,697	239	216	299	200	954
Westmoreland ...	320	66,693	403	425	419	316	1,563
St. Elizabeth ...	473½	79,153	404	353	346	379	1,482
Manchester	337	65,605	361	261	302	268	1,192
Clarendon	487	74,393	539	435	404	340	1,718
St. Catherine ...	498	88,606	677	539	511	493	2,220
Total	4,450¼	835,681	5,717	4,686	4,639	4,297	19,339

* Made up as follows :—

	£	s.	d.
Filling slaughter house swamp	86	19	1
Chapel Lane drain	170	8	11
New sewers	695	2	0
Pumping station	2,557	8	5
	3,509	18	5

15. Deaths registered in Kingston district:—

Estimated Population (mean).	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total year 1911.
57,514	183	157	180	123	164	153	142	122	114	103	130	124	1,695

16. Rainfall during the year 1911:—

Where observed.	District.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Returns from about 150 average stations.	North East ...	8·68	2·88	1·30	3·77	11·87	6·47	3·09	4·89	4·87	7·71	7·71	17·06	80·30
	North	4·74	1·32	0·79	1·48	9·16	2·38	1·90	1·74	3·95	6·28	3·67	9·12	26·53
	West Central ...	2·27	1·05	3·42	7·88	13·94	4·43	5·71	7·92	10·11	12·83	4·04	5·20	78·80
	South	1·71	0·52	2·58	2·86	6·33	1·97	2·20	2·92	3·90	6·28	4·26	2·46	37·99

17. Additional information to be given, if possible, on the following points:—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Number of notices, convictions, and warnings during the year.

Yes. Section 7 of Law 35 of 1910. Notices and Warnings, 9,626. Convictions, 16.

(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does Kala-azar exist?

No children examined during the year under review. Kala-azar does not exist here.

(*c*) Number of persons examined for filarial diseases. Where was this done? Percentage affected.

No examination has been made during the year.

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost.

Surface drainage of Kingston streets, drains and culverts at Morant Bay, Port Antonio, Port Maria, St. Ann's Bay, Falmouth, Montego Bay, Lucea, Sav-la-Mar, Black River, May Pen, Spanish Town. Reclamation of swamps at Kingston, Black River, Port Antonio, Port Maria, Annotto Bay, Spanish Town. *Approximate cost, £12,000.

(*e*) Number of men employed in towns and villages for petty anti-mosquito works. Approximate cost.

None exclusively except in Kingston, but Inspectors of Nuisances are employed in all towns and large villages, and are specially instructed in anti-mosquito work.

(*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed.

Sulphate of quinine (pure), 4,188 ounces. Quinine tablets, 3,519 lbs. The agencies employed are Public Hospitals, Parochial Boards, Post Offices, Police, Estates.

(*g*) Is quinine distributed regularly in the schools?

Yes, to all that apply. At present there are 250 schools receiving it.

(*h*) Measures taken against these diseases on estates employing indentured labour.

Employers are requested to supply quinine to indentured immigrants regularly (twice weekly), and to keep the barracks where they live clean and well drained.

(*i*) Any steps taken regarding the housing of the poor.

Poor-houses in every parish. Expenditure on poor relief, £56,000.

(*j*) Any exceptional increase or decrease of these diseases recently noticed.

* See Report of Malaria Commission for year ended 31st March, 1912.

A decided falling off in malaria except where indentured immigrants are located.

(*k*) Any other remarks on the subject.

Attention has been given to the hookworm disease, which is now fairly common among the barefoot class. Its introduction is probably due to immigrants arriving from India. Out of the first eight examined from latest arrivals ova were found in the fæces of seven of them. An examination of native prisoners in the Penitentiary shows that out of 428 examined 313 were infected.

STATISTICS regarding MALARIA amongst the Troops serving in Jamaica during the years 1909, 1910 and 1911.

European Troops.

Year.	Average Strength.	Deaths from all Diseases.	Deaths from Malaria.	Remarks.
1909	412	7	2	
1910	378	2	1	
1911	389	1	—	
Non-European Troops.				
1909	591	2	—	
1910	583	2	—	
1911	659	3	—	

NUMBER of CASES of MALARIA, and ratio per 1,000, by Stations.

European Troops.

Year.	Up Park Camp.		Port Royal.		Newcastle.	
	Number of Cases.	Ratio per 1,000.	Number of Cases.	Ratio per 1,000.	Number of Cases.	Ratio per 1,000.
1909	24	192·00	47	191·84	—	—
1910	6	61·86	43	182·98	5	108·70
1911	3	31·91	23*	104·55	5	66·66
Non-European Troops.						
1909	59	100·17	3	1,500·00	—	—
1910	36	61·96	—	—	—	—
1911	82†	124·81	—	—	—	—

* Mostly from Forts Clarence and Nugent.
† Over 40 cases from a Training Camp at Cane River in November.

No. 12.

LEEWARD ISLANDS.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1ST JANUARY TO 31ST DECEMBER, 1911.

(Received in Colonial Office, July 9, 1912.)

ANTIGUA.

1. Name of Colony, Antigua.
2. Total area, 108 square miles.

3. Estimated population :—

(a) Total, 31,394.
(b) European.
(c)
(d) Other races.
(e)

4. Births during the year :—

Total births, 1,286.

5. Deaths during the year :—

(a) Total deaths, 995.
(b) Deaths ascribed to fever.
(c) Deaths ascribed to blackwater fever. None.
(d) Deaths ascribed to yellow fever. None.

6. Government hospitals :—

(a) Number of such hospitals, 1.
(b) Totals during year :—

Admissions	951
Deaths	179

(c) Malarial fever :—

Admissions	23
Deaths	4

(d) Blackwater fever :—

Admissions	None.
Deaths	None.

(e) Yellow fever :—

Admissions	None.
Deaths	None.

(f) Filarial diseases :—

Admissions	18
Deaths	1

(g) Dengue :—

Admissions	None.
Deaths	None.

7. Government dispensaries :—

(a) Number of such dispensaries, none.
(b) Total attendances during year, none.
(c) Attendances for malaria, none.
(d) Attendances for filarial diseases, none.
(e) Attendances for dengue, none.

8. Medical service :—

(a) Number of Government Medical Officers, 6.
(b) Number of special Health Officers, none.
(c) Number of other registered practitioners, 3.

9. Schools :—

(a) Number of Government and State-aided schools, 32
(b) Number of scholars registered in these schools, 6,723.
(c) Percentage of daily attendances, 3,317.

10. Estates employing indentured labour :—

(a) Number of such, none.
(b) Number of indentured labourers employed, none.
(c) Number of hospitals and dispensaries on such estates, none.
(d) Total deaths among such labourers, none.
(e) Deaths ascribed to malaria, none.
(f) Total admissions and attendances at hospitals and dispensaries, none.

11. Estimated revenue of Colony :—

Total during year, £53,048 10s.

12. Estimated expenditure of Colony :—
   (*a*) Total during year, £52,786.
   (*b*) Annual medical and sanitary expenditure, £5,074 9s.
   (*c*) Upkeep of Government hospitals and dispensaries, £7,107 6s.
   (*d*) Total salaries and allowances of Medical Officers, £1,934 6s.
   (*e*) Total annual sanitary expenditure, £3,140 3s.

13. Towns and municipalities or town councils :—
   (*a*) Number of such, 1.
   (*b*) Total population, 9,262.
   (*c*) Total revenues, £2,105.
   (*d*) Total medical and sanitary expenditure, £4,108.

14. Table of deaths by districts :—

District.	Area.	Population.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
St. John's	Antigua.	14,175	51	43	37	40	45	33	37	45	47	56	70	67	571
St. Mary		4,276	7	4	7	7	3	6	6	3	—	14	10	14	81
St. Paul		4,317	13	7	9	9	9	9	8	10	6	16	12	11	119
St. Philip		2,972	6	2	3	6	4	4	4	5	3	11	3	15	66
St. Peter		2,827	9	5	7	4	4	2	7	2	2	4	9	7	62
St. George		2,827	11	7	5	1	9	7	6	7	6	13	15	9	96

15. Table of deaths in the principal towns :—

Town.	District where situated.	Population of Town.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
St. John's	St. John's	7,910	51	43	37	40	45	33	37	45	47	56	70	67	571

16. Rainfall during the year :—

Where observed.	District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
72 Stations ...	Antigua ...	3·45	2·55	0·76	1·85	3·22	0·98	2·35	2·31	5·34	5·18	4·20	4·28	36·47

17. Additional information to be given, if possible, on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Numbers of notices, convictions, and warnings during the year.—Yes.

(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does kala exist?—None.

(*c*) Number of persons examined for filarial diseases. Where was this done? Percentage affected?—None.

(*d*) Any large work for surface drainage of towns or reclamation of marshes? Approximate cost.—No.

(*e*) Number of men employed in towns and villages for petty anti-mosquito works. Approximate cost.—£4,510 18s. 10d.

(*f*) Amount of Government quinine distributed gratis during the year, £15. Agencies employed. Police stations.

(*g*) Is quinine distributed regularly in the schools?—No.

(*h*) Measures taken against these diseases employing indentured labour?—No.

ACTING CHIEF GOVERNMENT MEDICAL OFFICER.

ST. KITTS-NEVIS.

1. Colony of the Leeward Islands (Presidency of St. Kitts-Nevis).
2. Total area:—

St. Kitts, 65 square miles.
Nevis, 50 square miles.
Anguilla, 35 square miles.
Total, 150 square miles.

3. Estimated population:—

(*a*) Total, 50,572.
(*b*) Europeans.
(*c*) Other races.

4. Births during the year, 1,494.
5. Deaths during the year:—

(*a*) Total deaths, 1,072.
(*b*) Deaths ascribed to fever, 57.
(*c*) Deaths ascribed to blackwater fever, none.
(*d*) Deaths ascribed to yellow fever, none.

6. Government hospitals:—

(*a*) Number of hospitals, two.
(*b*) Totals during the year:—

Admissions	1,094
Deaths	104

(*c*) Malarial fever:—

Admissions	14
Deaths	—

(*d*) Blackwater fever:—

Admissions	—
Deaths	—

(*e*) Yellow fever:—

Admissions	—
Deaths	—

(*f*) Filarial diseases:—

Admissions	69
Deaths	6

(*g*) Dengue:—

Admissions	—
Deaths	—

7. Government dispensaries:—

(*a*) Number of such dispensaries, 6.
(*b*) Total attendances during the year, 2,134.
(*c*) Attendances for malaria, 155.
(*d*) Attendances for filarial diseases, 42.
(*e*) Attendances for dengue, none.

8. Medical service:—

(*a*) Number of Government Medical Officers, 7.
(*b*) Number of Special Health Officers, 2.
(*c*) Number of other registered practitioners, none.

9. Schools:—

(*a*) Number of Government and State-aided schools, 52.
(*b*) Number of scholars registered in these schools, 9,000
(*c*) Percentage of daily attendances, 50 per cent.

10. Estates employing indentured labour, none.

11. Estimated revenue of the Presidency, £51,390.

12. Estimated expenditure of the Presidency, £50,733.
(*b*) Annual medical and sanitary expenditure, £3,127.
(*c*) Upkeep Government hospitals and dispensaries, £2,509.
(*d*) Total salaries and allowances of Medical Officers, £2,232.
(*e*) Total annual sanitary expenditure, £1,095.

13. Towns under municipalities or town councils :—None.
(*a*) Number of such.
(*b*) Total population.
(*c*) Total revenues, £
(*d*) Total medical and sanitary expenditure, £

14. Table of deaths by districts :—

District.	Area sq. miles.	Population.	Total Deaths.												
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
St. Kitts ...	65	30,385	90	56	65	40	70	54	72	44	50	49	66	93	749
Nevis ...	50	15,193	17	10	17	30	35	26	26	18	27	27	37	54	323
Anguilla ...	35	4,994	9	3	4	8	7	4	6	5	5	7	11	11	80
Total ...	—	50,572	116	69	86	78	112	84	104	67	81	83	114	158	1,152

15. Table of deaths in the principal towns :—

Town.	District.	Population	Total Deaths.												
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total
Basseterre ...	St. Kitts	—	37	23	28	13	31	29	31	14	25	15	35	45	326
Charlestown	Nevis ...	—	3	2	3	5	5	6	4	3	2	4	4	16	56
Total ...	—	—	40	25	31	18	36	35	35	17	27	19	39	61	382

16. Rainfall during the year :—

Where observed.	District.	Rainfal .												
		Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Botanic Station Basseterre ...	St. Kitts	4·98	4·51	2·30	1·36	4·37	2·25	3·34	2·18	3·49	4·92	3·02	6 37	43·09
" Charlestown	Nevis ...	—	—	—	—	—	—	—	—	—	—	—	—	—
Wall Blake	Anguilla	2·56	3·13	·88	5·34	1·77	·46	·80	·83	·88	3·61	4·21	7·90	32·17

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—Yes. Number of notices, convictions, and warnings during the year?—None.

(*b*) Number of children examined for enlarged spleen : None
Where was this done?
Percentage affected
Does kala-azar exist?—No.

(*c*) Number persons examined for filarial diseases : None.
Where was this done?
Percentage affected %

(*d*) Any large works for surface drainage of towns or reclamation of marshes?
—No.

(*e*) Numbers of men employed in towns or villages for petty anti-mosquito works, 8.
Approximate cost, £200.
(*f*) Amount of Government quinine sold or distributed gratis during the year, none.
Agencies employed.
(*g*) Is quinine distributed regularly in the schools?—No.
(*h*) Measures taken against these diseases on estates employing indentured labour.—No such estates.
(*i*) Any steps taken regarding the housing of the poor?—None.
(*j*) Any exceptional increase or decrease of these diseases recently noticed?—No.
(*k*) Any other remarks on the subject.

W. H. Fretz,
Senior Medical Officer.

St. Kitts,
April 18th, 1912.

Montserrat.

Following the heads in draft return :—

1. Montserrat.
2. Thirty-two and a half square miles.
3. Population by census, 1911 :—
   (*a*) Total, 12,196.
   (*b*) European, 140.
   (*d*) Black and coloured, 12,056.
4. Births (total), 380.
5. Deaths (total), 187.

None ascribed to malaria, blackwater fever, or yellow fever.

6. Government hospitals :—
   (*a*) One.
   (*b*) Fifty-eight admissions, 4 deaths.
   (*c*), (*d*), (*e*), (*g*) No admissions for malaria, blackwater fever, yellow fever, or dengue.
   (*f*) One admission for filariasis. No death.
7. Government dispensaries :—
   (*a*) Three.
   (*b*) Total number of cases of non-paying patients treated during the year. 3,307.
   Total number of attendances not ascertainable.
   (*c*) Attendances for malaria only one (an imported case).
   (*d*) Attendances for filariasis, 27.
   (*e*) Attendances for dengue, none.
8. Medical service :—
   (*a*) Two Government Medical Officers.
   (*b*) One of the above is also Health Officer.
   (*c*) No other registered practitioners.
9. Schools :—
   (*a*) State-aided schools, 13. No Government schools.
   (*b*) Number of scholars registered in these, 3,085.
   (*c*) Percentage of daily attendances, 54·7.
10. There are no estates employing indentured labour.
11. Revenue of Presidency, 1910-11, £12,262.
12. Expenditure of Presidency, 1910-11, £11,366.
   (*b*) Annual medical and sanitary expenditure, £659.
   (*c*) Upkeep of Government hospitals and dispensaries, £86.
   (*d*) Total salaries and allowances of Medical Officers, £544.
   (*e*) Total annual sanitary expenditure, £115.

13. There are no towns under municipalities or town councils.
14. Table of deaths by districts :—

—	Districts—Parishes of				
	St. Anthony.	St. Patrick.	St. Peter.	St. George.	Total.
Area	—	—	—	—	—
Population	4,573*	819	3,545	3,259	12,196
January	8	2	5	2	17
February	2	1	6	4	13
March	6	2	3	—	11
April	6	—	3	3	12
May	2	—	4	3	9
June	5	2	5	4	16
July	8	3	4	3	18
August	6	—	5	4	15
September	12	2	2	3	19
October	7	—	4	8	19
November	8	—	4	4	16
December	8	1	3	10	22
Total	78	13	48	48	187

15. Table of deaths in the principal town :—

Town, Plymouth.
District where situated, St. Anthony's.
Population of town, 1,534, according to the Census, 1911.

Deaths :—

January	3
February	1
March	2
April	2
May	1
June	1
July	3
August	—
September	2
October	3
November	2
December	2
Total	22

16. Rainfall during the year :—

Where observed, Richmond.
District, St. Anthony's.

January	6·35
February	2·53
March	1·98
April	2·33
May	3·70
June	5·20
July	4·31
August	2·68
September	5·75
October	3·03
November	3·69
December	8·21
Total	49·76

* Including principal town.

This is about the average rainfall for the Island, the lowest on the windward side being 35·03 inches and the highest in the centre of the Island being 59·06 inches.

17. (*a*) Anti-mosquito regulations under the Board of Health Ordinance are being prepared, but are not yet in force.

(*b*) No children are examined systematically for enlarged spleens, and I have not seen a case here; no kala-azar.

(*c*) No systematic examinations for filarial diseases have been made.

(*d*) No large works for surface drainage beyond the ordinary paved gutters. There is only one swamp in the Island, about two miles from the town of Plymouth, not drained.

(*e*) No men are employed for anti-mosquito work.

(*f*) No quinine is sold or distributed gratis.

(*i*) No steps are taken regarding the housing of the poor, except that bad cases are boarded out.

(*j*) No increase or decrease of above diseases.

(*k*) All these diseases, except filariasis, are practically non-existent. Filarial diseases are comparatively rare in this Island.

W. G. Heath,
Acting Senior Medical Officer.

March 21st, 1912.

Dominica.

Return of Malarial Fever, Blackwater Fever, Yellow Fever, Filariasis, and Dengue during the Year from the 1st January to the 31st December, 1911.

1. Name of Colony, Presidency of Dominica.
2. Total area, 304⅔ square miles.
3. Estimated population :—
   (*a*) Total, 33,863.
   (*b*) European, 399.
   (*c*)
   (*d*) Other races : black, 21,361.
   (*e*) Coloured, 12,103
4. Births during the year :—
   Total births, 1,333.
5. Deaths during the year :—
   (*a*) Total deaths, 728.
   (*b*) Deaths ascribed to fever } Unknown.
   (*c*) Deaths ascribed to blackwater fever } Unknown.
   (*d*) Deaths ascribed to yellow fever } Unknown.
6. Government hospitals :—
   (*a*) Number of such hospitals, two.

(*b*) Totals, during year :—	
Admissions	0
Deaths	0
(*c*) Malarial fever :—	
Admissions	74
Deaths	13
(*d*) Blackwater fever :—	
Admissions	0
Deaths	0
(*e*) Yellow fever :—	
Admissions	0
Deaths	0
(*f*) Filarial diseases :—	
Admissions	0
Deaths	0

(g) Dengue :—

Admissions	0
Deaths	0

7. Government dispensaries :—
   - (a) Number of such dispensaries, 3.
   - (b) Total attendances during year, 5,482.
   - (c) Attendances for malaria, 590.
   - (d) Attendances for filarial diseases, 8.
   - (e) Attendances for dengue, 0.

8. Medical service :—
   - (a) Number of Government Medical Officers.
   - (b) Number of special Health Officers.
   - (c) Number of other registered practitioners, one.

9. Schools :—
   - (a) Number of Government and State-aided schools, 23.
   - (b) Number of scholars registered in these schools, 5,182.
   - (c) Percentage of daily attendances, 43·6 per cent.

10. Estates employing indentured labour, nil.

11. Estimated revenue of Presidency :—
    Total during year, £41,888.

12. Estimated expenditure of Presidency :—
    - (a) Total during year, £41,029.
    - (b) Annual medical and sanitary expenditure, £1,884.
    - (c) Upkeep of Government hospitals and dispensaries, £1,991.
    - (d) Total salaries and allowances of Medical Officers, £1,678.
    - (e) Total annual sanitary expenditure, £206.*

13. Towns under municipalities or town councils :—
    - (a) Number of such, one (Roseau).
    - (b) Total population, 6,577 (Census, 1911).
    - (c) Total revenues, £1,322 8s. 4d. (1910-11).
    - (d) Total medical and sanitary expenditure, £282 12s. 5d.

14. Table of deaths by districts :—

District.	Area.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
E.	$101\frac{5}{6}$	15,537	28	33	39	26	33	32	19	17	43	29	29	40	368
F.	73	9,426	15	13	8	6	15	19	13	8	16	10	11	10	144
G.	$129\frac{5}{16}$	8,900	13	14	16	9	16	19	22	19	20	18	29	21	216
Total ...	$304\frac{2}{3}$	33,863	56	60	63	41	64	70	54	44	79	57	69	71	728

15. Table of deaths in the principal towns :—

Town.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Roseau ...	E	6,577	11	17	19	10	14	18	6	7	21	17	10	25	175
Portsmouth	G	1,023	1	4	6	3	7	2	9	8	6	4	13	4	67
Total ...	—	7,600	12	21	25	13	21	20	15	15	27	21	23	29	242

* Exclusive of Municipal Expenditure in the Town of Roseau.

16. Rainfall during the year :—

Station.	January	February.	March.	April.	May.	June.	July	August.	September.	October.	November.	December.	Total.
Agricultural School	12·06	4·33	3·18	3·70	10·89	7·30	7·97	10·96	16·82	8·18	7·57	6·75	99·71
Antrim Valley	13·77	4·91	4·08	6·49	14·42	12·03	13·18	14·91	19·26	10·02	10·22	12·51	135·80
Batalie	6·68	1·90	0·00	0·50	7·85	2·27	8·70	7·60	15·42	4·12	3·76	3·61	62·41
Bellevue	15·19	13·66	5·64	9·57	22·73	15·01	9·89	15·04	25·27	15·42	15·15	12·03	174·60
Blenheim	7·67	6·45	3·43	2·32	12·33	8·35	8·15	9·20	14·67	12·52	12·81	10·08	107·98
Botanic Gardens	11·46	4·00	3·11	5·00	11·16	6·54	8·08	11·43	15·34	7·06	6·94	7·14	97·26
Canefield	8·72	3·49	3·25	3·26	8·79	9·17	9·24	11·01	17·21	6·90	6·01	6·91	93·96
Castleacre	13·29	5·65	5·71	6·02	14·15	15·37	13·41	16·38	24·02	10·77	10·34	12·13	147·24
Castle Bruce	3·72	23·52	4·00	2·62	5·67	7·00	1·72	26·20	16·43	4·32	17·00	16·80	129·00
Concord	10·52	19·51	7·87	8·88	23·00	10·60	9·84	14·25	25·39	14·64	19·57	18·19	182·26
Corlet	18·88	16·12	9·21	9·80	25·91	16·75	14·60	19·18	30·93	19·13	22·56	16·52	219·59
Everton	8·86	3·37	3·41	4·32	12·49	11·99	8·08	10·46	18·92	6·59	17·80	9·69	115·98
Gleau Manioc	23·56	15·09	13·56	16·74	38·20	19·78	12·94	27·36	31·12	21·25	34·87	16·00	270·47
Goodwill	9·34	3·86	3·04	2·71	10·92	7·41	8·39	9·26	16·73	6·25	5·89	6·35	90·15
Governor	11·35	13·47	6·87	8·74	21·08	9·73	10·50	14·29	23·13	11·18	16·83	10·47	157·64
Hampstead	5·99	7·54	2·85	5·64	12·28	8·73	6·95	9·92	15·16	5·97	11·67	6·14	98·84
Hatton Garden	4·72	11·23	4·77	4·09	17·51	6·29	7·69	9·10	15·67	10·26	10·36	17·12	118·81
Hillsborough	9·83	3·21	2·03	2·68	7·47	10·44	8·37	13·08	15·33	5·06	7·32	6·73	91·55
Kinellan	17·54	7·12	5·15	7·17	18·60	13·79	12·59	18·07	28·26	8·65	19·28	10·57	166·79
La Haut	10·33	5·66	3·67	5·05	14·37	9·68	9·00	11·21	14·64	9·74	9·54	9·07	111·96
Lisdara	16·52	11·74	7·23	9·45	25·25	14·29	11·46	13·48	27·76	16·35	16·10	13·14	182·77
Londonderry	5·43	7·73	3·42	5·69	14·38	6·34	6·74	8·23	15·21	7·75	10·67	10·05	101·64
Long Ditton	26·81	13·06	9·86	15·64	25·60	25·23	14·95	20·53	33·52	11·39	18·47	15·70	230·76
Macoucherie	6·84	3·10	·76	2·38	6·50	8·02	7·79	6·02	14·11	2·32	4·98	3·54	66·36
Melville Hall	5·31	9·83	3·98	4·83	17·53	7·66	7·66	10·52	15·26	9·10	11·40	13·14	116·22
Moore Park	7·51	5·65	2·50	1·12	8·89	16·96	7·90	11·19	14·80	10·62	9·40	12·53	109·07
Picard	9·02	2·44	2·36	4·85	5·79	9·47	5·45	9·49	14·90	6·12	7·57	5·13	82·59
Point Mulatre	7·17	12·00	8·16	6·67	18·12	7·65	6·40	10·66	8·90	3·74	10·69	9·13	109·29
Rosalie	7·19	20·76	9·66	8·65	16·68	7·51	6·31	15·25	24·64	12·96	12·37	20·66	162·64
Saltoun	24·53	11·77	12·25	14·82	28·44	26·97	19·36	23·18	30·78	14·78	27·93	14·64	249·45
Shawford	17·43	9·69	6·51	11·60	20·23	22·55	10·51	16·69	23·33	10·20	10·92	13·16	172·82
Snug Corner	13·48	8·65	6·05	6·01	19·38	8·33	7·57	4·85	15·00	7·39	6·34	9·26	112·31
Soufrière	8·28	9·53	7·77	5·68	13·09	10·06	7·56	9·09	21·20	11·41	7·20	3·70	114·57
St. Aroment	12·55	3·93	3·67	4·44	11·65	6·65	9·28	11·00	19·15	6·39	7·93	8·45	105·09
Wall House	6·83	4·60	2·45	2·73	9·60	6·12	5·20	7·05	14·60	8·25	8·25	5·65	81·33
Woodford Hill	6·94	8·35	2·67	3·91	17·70	7·31	7·68	8·65	15·65	6·88	10·02	12·12	107·88

Mean Rainfall 36 Stations, 132·69 inches.
„ „ 14 Leeward Coast Stations, 94·66 inches.
„ „ 3 Windward „ „ 133·64 „
„ „ 12 Inland Stations, 190·85 „
„ „ 6 La Soye Coast Stations, 108·53 „

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—No.

Numbers of notices, convictions, and warnings during the year.

(*b*) Number of children examined for enlarged spleen.—30.

Where was this done?—Portsmouth Government Dispensary.

Percentage affected.—25 per cent.

Does kala-azar exist?—No.

(*c*) Number of persons examined for filarial diseases.—0.

Where this was done?

Percentage affected.

(*d*) Any large works for surface drainage of towns or reclamation of marshes.—No.

Approximate cost.—Nil.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works.—None.

Approximate cost.—Nil.

(*f*) Amount of Government quinine sold or distributed gratis during the year.—$7\frac{1}{4}$ gross pills.

Agencies employed.—Police.

(*g*) Is quinine distributed regularly in the schools?—No.

(*h*) Measures taken against these diseases on estates employing indentured labour.—No indentured labour.

(*i*) Any steps taken regarding the housing of the poor.—No.

(*j*) Any exceptional increase or decrease of these diseases recently noticed.—No.

(*k*) Any other remarks on the subject. Nil.

No. 13.

WINDWARD ISLANDS (St. Vincent).

The GOVERNOR to the SECRETARY OF STATE.

(Received June 11, 1912.)

Grenada, 23rd May, 1912.

Submitted with reference to the correspondence ending with my despatch of the 5th April, 1911.*

J. HAYES SADLER,
Governor.

Sir, Government House, St. Vincent, 14th May, 1912.

With reference to previous correspondence on the subject of the preparation of a return of mosquito-borne diseases suggested by Professor Ronald Ross, I have now the honour to forward a return containing such information as it is possible to furnish in regard to this Colony.

2. I regret the delay which has taken place in furnishing this return. This has been unavoidable. In the absence of a head of the Medical Department in St. Vincent the return has had to be compiled in my office from information obtained from the District Medical Officers and from several other sources, and it has not been possible until recently to devote to its preparation the time and attention necessary on account of pressure of other important work.

3. I shall be obliged if Your Excellency will inform me whether it is intended that the return should be furnished regularly every year. In this connection I would point out that mosquito-borne diseases do not assume the importance in St. Vincent they seem to do in other places, and that such returns would not, therefore, contain information of a very valuable character.

I have, &c.,
C. Gideon Murray,
Administrator.

His Excellency
Lieutenant-Colonel
Sir James Hayes Sadler, K.C.M.G., C.B.,
&c., &c., &c.,
Grenada.

Enclosure in No. 13.

Return of Malarial Fever, Blackwater Fever, Yellow Fever, Filariasis, and Dengue during the Year from 1st April, 1910, to 31st March, 1911.

1. Name of Colony—St. Vincent.
2. Total area—150·3 square miles.
3. Estimated population :—
   (a) Total—41,877 (according to Census, 2nd April, 1911).
   (b) Europeans } Information not available.
   (c) Other races }
4. Births during the year :—
   Total births—1,661.
5. Deaths during the year :—
   (a) Total deaths—835.
   (b) Deaths ascribed to fever—7.
   (c) Deaths ascribed to blackwater fever—Nil.
   (d) Deaths ascribed to yellow fever—Nil.

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* No. 21 in Appendix I. in [Cd. 6024].

6. Government hospitals :—*

(*a*) Number of such hospitals—One.
(*b*) Totals during the year—Admissions, 820; deaths, 36.
(*c*) Malarial fever—Admissions, 12; deaths, 1.
(*d*) Blackwater fever—Admissions, nil; deaths, nil.
(*e*) Yellow fever—Admissions, nil; deaths, nil.
(*f*) Filarial diseases—Admissions, 15; deaths, nil.
(*g*) Dengue—Admissions, nil; deaths, nil.

7. Government dispensaries :—

(*a*) Number of such dispensaries—5.
(*b*) Total attendances during year—16,481.†
(*c*) Attendances for malaria—201.†
(*d*) Attendances for filarial diseases—82.†
(*e*) Attendances for dengue—Nil.

8. Medical service :—

(*a*) Number of Government Medical Officers—Seven.
(*b*) Number of special Health Officers: by law, each Medical Officer is Health Officer in his district.
(*c*) Number of other registered practitioners—Sixteen, of whom only two reside in the Colony.

9. Schools :—

(*a*) Number of Government and State-aided schools—26.‡
(*b*) Number of scholars registered in these schools—4,551 (at 31st March, 1911).
(*c*) Percentage of daily attendances—2,150 (*average* attendance).

10. Estates employing indentured labour—None.

11. Estimated Revenue of Colony :—

Total during year—£28,895.

12. Estimated Expenditure of Colony :—

(*a*) Total during year—£28,878.
(*b*) Annual medical and sanitary expenditure—£2,018.
(*c*) Upkeep of Government hospitals and dispensaries—£2,711.
(*d*) Total salaries and allowances of Medical Offices—£1,750.
(*e*) Total annual sanitary expenditure—£25.§

13. Towns under Municipalities or Town Councils :—

(*a*) Number of such—6.
(*b*) Total population—7,682 (3,264 males and 4,418 females).
(*c*) Total revenues (for 1910)—£1,984 15s. 7d.
(*d*) Total medical and sanitary expenditure (1910)—£300 9s. 2d.

14. Table of Deaths by districts :—

District.	Area.	Population.	Total Deaths.												
			April, 1910.	May.	June.	July.	August.	September.	October.	November.	December.	January, 1911.	February.	March.	Total.
First District	—	—	28	25	16	25	17	30	14	14	25	26	29	16	265
Second District	—	—	41	30	31	53	31	40	63	43	61	52	42	52	539
Third District	—	—	0	1	0	5	4	4	2	1	6	4	1	3	31
Total	—	—	69	56	47	83	52	74	79	58	92	82	72	71	835

* General.

† These figures represent the number of *cases*, each of which may have been *attended* two or three times. Attendances cannot be given.

‡ These are elementary schools fully recognised. Besides a number of private schools, there are a few other "aided" elementary schools in regard to which no statistics are available. There are also two recognised Secondary Schools in regard to which statistics cannot be given.

§ For specific purposes.

15. Table of deaths in the principal towns :—

Town.	District where situated.	Population of Town.	Total Deaths.												
			April, 1910.	May.	June.	July.	August.	September.	October.	November.	December.	January, 1911.	February.	March.	Total.
Kingstown	—	—	18	12	8	14	11	12	5	7	12	13	13	11	136
Calliaqua	—	—	1	0	1	1	0	4	2	1	0	0	2	2	14
Georgetown...	—	—	2	2	1	4	2	0	0	2	1	1	2	1	18
Layou	—	—	2	0	1	1	0	2	1	0	2	3	1	1	14
Barrouallie	—	—	0	0	1	3	1	3	5	0	6	5	5	4	33
Chateaubelair	—	—	2	1	0	2	1	0	1	1	2	0	0	1	11
Total	—	—	25	15	12	25	15	21	14	11	23	22	23	20	226

16. Rainfall during the year :—

Where observed.	District.	Rainfall.												
		April, 1910.	May.	June.	July.	August.	September.	October.	November.	December.	January, 1911.	February.	March.	Total.
														inches.
Botanic Station (200 ft.).	Leeward (South).	4·41	15·33	12·19	11·66	11·22	7·94	9·11	6·78	6·99	5·41	8·05	3·60	102·69
Agricultural School.	Leeward (South).	3·62	15·25	10·46	9·12	8·77	7·46	9·34	6·74	5·87	5·24	5·83	2·17	89·87
Georgetown ...	Windward (North).	4·40	13·24	16·20	5·53	7·67	9·56	7·96	4·55	4·37	6·87	6·71	3·15	90·21
Ratho Mill ...	Windward (South).	4·10	15·31	7·60	8·13	4·13	5·61	8·09	5·37	3·91	3·40	4·40	1·82	71·87
Bequia	Grenadines (North).	7·28	7·80	5·42	8·36	9.13	6·99	6·28	3·23	5·76	4·29	5·85	·63	71·02
Peter's Hope ...	Leeward (Middle).	2·59	12·26	10·29	8·98	10·17	Not taken.	6·16	3·17	2·65	3·33	3·24	·88	63·72
Villa Point ...	Windward (South).	3·49	12·32	6·74	5·69	7·32	1·76	6·01	5·24	2·77	3·98	4·34	1·04	60·70
	Total ...	29·89	91·51	68·90	57·47	58·41	39·32	52·95	35·08	32·32	32·52	38·42	13·29	550·08

17. Additional information to be given, if possible, on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitos in premises?—Yes, in the Public Health Ordinance, 1910, Sections 9 and 19.

Number of notices, convictions, and warnings during the year—None.

(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected.—No systematic examination was carried out.

Does Kala-azar exist?—No cases diagnosed.

(*c*) Number of persons examined for filarial diseases. Where was this done? Percentage affected.—No systematic examination was carried out.

(*d*) Any large works for surface drainage of towns or reclamation of marshes—In Kingstown a large new surface drain was constructed. Approximate cost—£200.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works : approximate cost—In Kingstown there is a Sanitary Inspector continuously employed at £36 per annum. When necessity exists therefor others are taken on temporarily. In addition, the Government employs a man to inspect the environs of Kingstown for stagnant water, &c., regularly. Elsewhere in the Colony such inspectors are only employed when necessary.

(*f*) Amount of Government quinine sold or distributed gratis during the year—About 6 lbs.

Agencies employed—Hospitals and dispensaries.

(*g*) Is quinine distributed regularly in the schools?—No. Unnecessary.

(*h*) Measures taken against these diseases on estates employing indentured labour—No indentured labour.

(*i*) Any steps taken regarding the housing of the poor—None.
(*j*) Any exceptional increase or decrease of these diseases recently noticed—No.
(*k*) Any other remarks on the subject—No.

No. 14.

NORTHERN TERRITORY OF AUSTRALIA.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1st JANUARY TO THE 31st DECEMBER (1911).

(Received in Colonial Office, September 16, 1912.)

1. Name of Colony : Northern Territory of Australia.
2. Total area : 531,400 sq. miles.
3. Estimated population :—
   (*a*) Total : 3,005 whites and Asiatics (about 20,000 aboriginals).
   (*b*) Europeans : 1,173.
   (*c*) Chinese : 1,340.
   (*d*) Other races : 482.
   (*e*) Aboriginals : Rather less than 20,000.

4.* Births during the year :— { Europeans, 9; Chinese, 39; Others, 8 } Total, 56.

5.* Deaths during the year :—
   (*a*) Total deaths : 68 { Europeans, 22. Chinese, 37. Others, 9.
   (*b*) Deaths ascribed to fever : 6.
   (*c*) Deaths ascribed to blackwater fever : Nil.
   (*d*) Deaths ascribed to yellow fever : Nil.

6. Government Hospitals :—
   (*a*) Number of such hospitals : 1.
   (*b*) Totals, during year { admissions : 151. Deaths : 15.
   (*c*) Malarial fever { admissions : 14. deaths : Nil.
   (*d*) Blackwater fever { admissions, deaths } Nil.
   (*e*) Yellow fever : Nil.
   (*f*) Filarial Diseases : Nil.
   (*g*) Dengue : Nil.

7. Government Dispensaries : Nil.
8. Medical Service :—
   (*a*) Number of Government Medical Officers : two.
   (*b*) Number of special Health Officers: Nil.
   (*c*) Number of other registered practitioners : one.
9. Schools :—
   (*a*) Number of Government and State-Aided Schools : 3.
   (*b*) Number of scholars registered in these schools : 109.
   (*c*) Percentage of daily attendances : 59·61.
10. Estates employing indentured labour : Nil.
11. Estimated revenue of Colony :—
    Total during year : £64,255 7s. 1d.
12. Estimated expenditure of Colony :—
    (*a*) Total during year : £62,450 7s. 4d.
    (*b*) Annual medical and sanitary expenditure : Nil (apart from figures given below).

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* There are no birth or death or population statistics of the aboriginal inhabitants.

(*c*) Upkeep of Government Hospitals: £1,784.
(*d*) Total salaries and allowances of medical officers : £560.
(*e*) Total annual sanitary expenditure : Nil.

13. Towns under Municipalities or Town Councils :—
(*a*) Number of such : one.
(*b*) Total population, 1,053.
(*c*) Total revenues, £791 16s. 10d.
(*d*) Total sanitary expenditure : £197 10s. 6d.

14. Table of deaths by Districts : (Northern Territory is one District) :—
Area : 531,400 sq. miles. Population : 3,005, whites and Asiatics.

January	7
February	6
March	5
April	9
May	5
June	8
July	6
August	4
September	7
October	5
November	1
December	5
Total	68

15. Table of deaths in the principal towns :—
(One Town), Darwin.
Town : Darwin. District where situated : No division of Territory into districts. Population of town: 1,053.

January	1
February	1
March	2
April	3
May	1
June	1
July	2
August	0
September	3
October	2
November	1
December	2
Total	19

16. Rainfall during the year 1911 :—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Darwin ...	Coastal ...	10·97	9·77	·81	10·37	—	—	·01	·01	—	2·82	3·11	4·23	42·10
Brock's Creek ...	Inland	11·51	6·43	3·60	3·07	—	—	—	—	—	3·25	1·65	4·14	33·70
Pine Creek ...	Inland	9·26	5·17	2·89	1·96	—	—	—	—	—	3·03	3·31	7·94	33·56
Katharine ...	Inland	3·11	8·05	·97	1·52	—	—	—	—	—	2·26	2·07	10·07	28·05
Daly Waters ..	Inland	2·00	5·44	2·86	4·39	—	—	—	—	·89	·24	5·13	3·49	24·44
Powell's Creek	Inland	·34	·31	1·18	2·71	—	—	—	—	1·05	1·65	2·65	3·68	13·57

17. Additional information to be given if possible on the following points :—
(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—No legislation.
(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does Kala-azar exist?—No. No systematic examination.

(*c*) Number of persons examined for filarial diseases?—No examination.
(*d*) Any large works for surface drainage of towns or reclamation of marshes?—No.
(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works?—Nil.
(*f*) Amount of Government quinine sold or distributed gratis during the year?—No systematic distribution.
(*g*) Is quinine distributed regularly in the schools?—No.
(*h*) Measures taken against these diseases on estates employing indentured labour?—No such estates.
(*i*) Any steps taken regarding the housing of the poor?—No.
(*j*) Any exceptional increase or decrease of these diseases recently noticed?—No.

No. 15.

AUSTRALIA (PAPUA).

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM 1st JULY, 1910, TO 30th JUNE, 1911.

(Received in Colonial Office, July 22, 1912.)

1. Name of Colony: Territory of Papua.
2. Total area: 90,540 square miles.
3. Estimated population:—
   (*a*) Total, 272,057.
   (*b*) Europeans, 1,032.
   (*c*) Aboriginal Papuans, 270,745.
   (*d*) Other races (coloured aliens), 280.
4. Births during year:—
   (*European only*), 11.
5. Deaths during the year:—
   (*a*) Total deaths (*European and Coloured, other than Papuan, only*), 21.
   (*b*) Deaths ascribed to fever, 1.
   (*c*) Deaths ascribed to blackwater fever, 2.
   (*d*) Deaths ascribed to yellow fever, 0.
6. Government Hospitals:—
   (*a*) Number of such hospitals, 5.
   (*b*) Totals during year—
   Admissions, 1,232.
   Deaths, 67.
   (*c*) Malarial Fever—
   Admissions, 39.
   Deaths, 1.
   (*d*) Blackwater Fever—
   Admissions, 1.
   Deaths, 1.
   (*e*) Yellow fever, nil.
   (*f*) Filarial diseases, nil.
   (*g*) Dengue fever, nil.
7. Government Dispensaries:—
   (*a*) Number of such dispensaries, 5.
   (*b*) Total attendances during year, 643.
   (*c*) Attendances for malaria, 78.
8. Medical Service:—
   (*a*) Number of Government Medical Officers, 4.
   (*b*) Number of Special Health Officers, 0.
   (*c*) Number of other Registered Practitioners, 1.

9. Schools:—
   (*a*) Number of Government and State-aided schools, 2.
   (*b*) Number of scholars registered, 33.
   (*c*) Percentage of daily attendance, 30.

10. Estates employing indentured labour:—
   (*a*) Number of such, 120.
   (*b*) Number of labourers employed (including all labour, agricultural and otherwise), 8,765.
   (*c*) Dispensaries on estates, 58.
   (*d*) Total deaths (including all labourers), 357.
   (*e*) Deaths ascribed to malaria: (no means of acquiring information).
   (*f*) Total admissions and attendances at hospitals and dispensaries: (no means of acquiring information).

11. Revenue of Colony:—
   Total during year ended 30 June, 1911, £48,454 10s. 7d.*

12. Expenditure of Colony:—
   (*a*) Total during year ended 30 June, 1911, £70,698 19s. 3d.
   (*b*) Annual medical and sanitary expenditure, £6,346 17s. 1d.
   (*c*) Upkeep of Government hospitals and dispensaries, £3,900 2s. 5d.
   (*d*) Total salaries and allowances of medical officers, £2,373 6s. 8d.
   (*e*) Total annual sanitary expenditure, £73 8s.

13. Towns under municipal control: nil.
14. Table of deaths by districts: (information not available).
15. Table of deaths in principal towns: (information not available).
16. Rainfall during the year:—

Station.	District.	1910.						1911.						Total.
		July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
Port Moresby ...	Central ...	0·520	0·380	0·095	2·290	7·205	2·595	2·830	17·850	3·955	2·140	1·266	1·170	42·296
Samarai ...	Eastern ...	6·637	27·286	29·320	8·320	8·270	6·810	4·330	10·060	6·710	10·790	10·550	12·300	141·383
Daru	Western ...	4·730	4·510	4·930	2·232	4·702	7·044	8·835	8·713	12·069	4·166	6·570	5·770	74·271
Kerema ...	Gulf ...	6·080	7·770	8·910	13·420	6·320	6·640	4·690	11·600	7·390	9·120	12·200	14·060	108·220
Nepa	Lakekamu ...	8·430	10·720	29·070	20·400	24·370	23 400	14·600	10·850	18·460	16·100	15·400	25·070	216·87
Kairuku ...	Mekeo ...	No record	0·175	0·195	2·078	2·440	4·885	3·960	19·020	6·255	4·800	—	No record	33·308
Hombron Bluff	Central ...	2·710	3·550	4·470	8·400	4·450	5·760	14·270	15·230	6·410	5·700	4·180	1·820	77·15
Rigo	"	0·200	1·160	1·310	1·450	1·700	2·410	3·050	8·860	8·920	6·610	0·190	1·500	37·36
Kemp Welsh ...	"	0·660	1·360	4·630	2·690	5·540	6·590	6·630	6·120	7·080	7·600	0·920	0·770	50·59
Tufi	North Eastern.	4·620	19·610	17·060	5·800	25·500	12·490	11·600	51·550	21·810	7·610	14·950	6·130	198·73
Buna Bay ...	Kumusi ...	3·430	14·610	5·380	9·420	32·790	19·720	11·740	7·300	15·330	7·630	11·190	8·160	146·7
Kokoda ...	"	3·660	No record	9·495	10·190	25·158	17·660	17·990	30·060	9·010	8·510	—	11·080	142·813
Ioma	Mambari ...	2·220	2·646	5·515	3·278	27·710	21·220	22·120	15·000	9·280	1·020	10·250	5·350	125·609
Bonagai ...	South Eastern.	13·230	23·330	24·110	13·240	6·370	19·560	8·430	28·130	20·700	30·720	6·470	9·445	203·735
Losuia	Trobriand ...	14·890	29·600	11·630	12·290	7·570	10·680	13·490	22·830	17·520	9·840	11·310	16·520	178·17
Ambasi ...	Mambari ...	5·520	14·610	6·720	5·850	13·420	6·950	8·620	4·300	4·600	7·690	15·220	11·610	104·61

17. Additional information to be given, if possible, on the following points:—
   (*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Number of notices. Convictions and warnings during the year.
   Yes. No convictions during year. Numerous warnings and notices posted, but no record kept.
   (*b*), (*c*), (*d*), and (*e*) Nil.
   (*f*) Amount of Government quinine sold or distributed gratis during the year: 435 ozs.
   (*g*) Is quinine distributed regularly in the schools? No.
   (*h*) Measures taken against these diseases on estates employing indentured labour:—The usual sanitary arrangements.
   (*i*), (*j*), (*k*) Nil.

* Deficiency between revenue and expenditure made up by special grant from the Commonwealth of Australia.

No. 16.

NEW HEBRIDES.

THE HIGH COMMISSIONER FOR THE WESTERN PACIFIC to THE SECRETARY OF STATE.

(Received June 11, 1912.)

Office of the High Commissioner for the Western Pacific,
Suva, Fiji, 10th May, 1912.

SIR,

I HAVE now the honour to forward for your information a copy of a letter, together with its enclosures, which I have received from the Resident Commissioner for the New Hebrides upon the subject of your Circular of 20th December, 1910.*

I have, &c.,
F. H. MAY.

Enclosure in No. 16.

(New Hebrides. No. 55/12.)

British Residency, Vila, 22nd March, 1912.

SIR,

WITH reference to the Circular of the Secretary of State for the Colonies of 20th December, 1910, and Sir Henry May's despatch of 4th July last, I have the honour to forward herewith copies of the only replies that I have received from medical men resident in this group to the enquiries addressed to them on the subject of Dr. Ross's memorandum on mosquito-borne diseases.

I have, &c.,
M. KING,
Resident Commissioner.

His Excellency
the High Commissioner
for the New Hebrides.

Memorial Hospital, Vila, New Hebrides, 21st August, 1911.

SIR,

IN reply to your letter dated the 18th instant, I have the honour to state that the number of cases of malaria treated in the "Memorial Hospital," Vila, since its opening on January 14th, 1911, until the end of July, was 55; deaths, 1.

For the same seven months the number of cases of filarial disease was 3; blackwater fever, 0; dengue, 0; the patients who attended the hospital for advice and medicine only, during the above period of seven months, numbered 363. A record has been kept of each attendance, but the complaints from which they suffered have not been classified.

I have, &c.,
DAVID CROMBIE.

To H.B.M. Resident Commissioner
for the New Hebrides.

Nogugu, Santo, 22nd September, 1911.

SIR,

I BEG to acknowledge the receipt of your letter of 18th ultimo. Up to one month ago I kept no statistics, as my hospital wasn't erected. Henceforth I will be able to furnish any information required.

Practically all the people in our villages suffer from malaria, and there are many cases of elephantiasis. I have had one case of blackwater fever and one case of dengue. Consumption is very prevalent, and during the last two months we have had a severe epidemic of influenza and two cases of pneumonia.

I have, &c.,
W. TAYLOR.

M. King, Esq.,
H.B.M. Resident Commissioner,
Vila.

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* No. 11 in Appendix I. in [Cd. 5514].

DEAR SIR, Anelgauhat, Aneityum, 14th October, 1911.

IN reply to your letter of August 18th, asking information about diseases of the islands under my charge, I beg to say that I can only give you a general idea, for (1) I have no hospital, partly owing to the small population of the two islands, and partly because I require to move from one station to another so frequently; and (2) though I have dispensaries in both Futuna and Aneityum, the cases have for some years been so few that I have not kept a correct account of them for my Church. However, with regard to Futuna, there is practically *no* malarial fever. The few cases which have now and again appeared have been in natives who caught the infection in other islands, but they recovered soon after coming to Futuna. As to other diseases in that island the chief has been, for a number of years, *phthisis.* But for this, introduced first from abroad, there would have been no decrease in the population within the last 16 years. This disease is, however, now decreasing. Last year influenza was introduced, and, while I was absent at Aneityum and Aniwa, 10 natives died from this cause. The other (minor) diseases are colds, or, as I prefer to say, " island influenza," and diseases of the alimentary canal, as, indigestion, constipation, &c. The variety has been small. Also, some cases of irritable sores or ulcers. Futuna is free of specific (syphilitic) disease.

Aneityum.—Last year, 1910, was a comparatively healthy year, and the cases of *malaria*—always more or less present—were few. Rheumatism is very common, not only among the old or middle-aged, but sometimes among young adults. " Island influenza " appears more or less every year, also the cases similar to Futuna mentioned above. This year, 1911, malaria followed by enlarged spleen was exceptional; about 97 per cent. were attacked of adults, and about 50 per cent. of the children. That is, out of about (say) 250 adults, only six or eight escaped, and out of the remaining 120 young people and children from 60 to 70 were attacked with malaria. As I was in Futuna when the epidemic (as I may call it) was at its worst, I dispensed medicine to about 80 of the above cases, sometimes twice or thrice to the same persons, thus making about (say) 170 attendances. Then there were about 6 cases of pneumonia following. The deaths from fever were 4, and from pneumonia, 1.

Blackwater fever and dengue have not yet reached Futuna and Aneityum.

There are no true filarial diseases in Futuna.

Including elephantiasis as a filarial disease, there is only one known case in Aneityum. A number of years ago (twenty and more) there were a number of cases.

Though fragmentary, I trust the above may be of some general use, though of little value statistically.

I have, &c.,

WILLIAM GUNN,

Missionary.

H.B.M. Resident Commissioner,
Vila, New Hebrides.

APPENDIX II.

Report of the Professor of Protozoology at the University of London for the year ending June 30th, 1912.

(Received September 28, 1912.)

There are no changes to report with regard to the *personnel* of this Department. During the whole year covered by this report, I have been working at the Lister Institute.

The greater part of my time during the past year has been taken up by finishing off my book on protozoa and seeing it through the Press, a task which involved much more time and labour than I had reckoned for. The book is now quite out of my hands, and will, I hope, appear shortly; it is entitled " An Introduction to the Study of the Protozoa, with Special Reference to the Parasitic Forms," and it is intended to furnish a guide to those students and investigators of all classes who, having some general knowledge of biology, desire a closer acquaintance with the special problems presented by the protozoa. The main portion of the book consists of 474 pp. with 194 illustrations in the text, exclusive of the preface, bibliography and index, which bring it up to a total of xii. + 517 pp. In its plan and arrangement the book is based upon the general course of lectures delivered by me here. It is published by the firm of Edward Arnold.

My work, apart from the preparation of this book, may be divided, as in my previous reports, into (1) research and (2) teaching work.

1. *Research.*—I have been occupied chiefly in continuing to collaborate with Dr. J. D. Thomson in investigations upon the transmission of the rat-trypanosome, *T. lewisi*, by the rat-flea, and its development in this insect. In my last report ([Cd. 6024], pp. 71-76), I gave a full account of the problems with which we were occupied, the methods of experiment and observation employed by us, and the results we had then obtained; it will not be necessary, therefore, for me to repeat all that I set forth then; it will be sufficient, I think, for me to report simply on the progress which we have made in our investigations.

(a) *Transmission.*—We have not as yet succeeded, I regret to say, in settling the main problem of the transmission, that is to say, how the trypanosome passes from the flea into the rat. The conclusions which we had reached a year ago and which were set forth by me in my last report were " that the final form of the development of the trypanosome . . . is produced in the rectum (of the flea) . . . and passes forward to the stomach. . . The facts appear to indicate strongly that the infection of the rat is brought about by the regurgitation of the ripe form from the stomach at the time the flea feeds, but the occurrence of this form in the rectum leaves the possibility open that it may also pass out with the fæces." ([Cd. 6024], p. 75.)

During the past year the results of an investigation on the transmission of *Trypanosoma lewisi* by the agency of fleas have been published by W. Nöller (*Archiv für Protistenkunde* XXV., 1912, pp. 386-424). One of this author's conclusions is that the flea " transmits the rat-trypanosome through its fæces, which are licked off by the rat." In my last report I mentioned (p. 73) that we had done some experiments to determine whether rats can become infected by eating the fæces of infected fleas, and stated that all such experiments had given negative results, indicating that infection did not take place in this way; I alluded also to the possibility that fæces might produce an infection if they came into contact with a scratch or lesion on the skin, a possibility which remained to be tested. Nöller's conclusions are, therefore, the opposite to ours, but, since his are founded on positive evidence and ours only on negative results, they have a far greater importance from the purely logical point of view, as I was careful to point out previously (p. 74). It may very well be true, therefore, that the rat can become infected by the fæces of the flea accidentally swallowed, although our own experience affords us no confirmation of this statement. But even if this is a possible mode of infection, we are by no means convinced that this is the usual mode of infection; we still believe that the normal method of infection of the rat is by the passage of the trypanosome through the proboscis of the flea, in a manner similar to that known to occur in many other trypanosome-infections by the agency of blood-sucking invertebrates. We have shown that the little stumpy trypanosome-form which is the end of the development in the

flea is produced in the rectum by modification of the crithidial form; if now this "ripe" form is destined merely to pass out from the rectum with the fæces, there is no reason why it should migrate forward from the rectum to the stomach, as numerous experiments and observations of ours have proved it to do (see previous report, pp. 74, 75). With regard to Nöller's results, it should be further pointed out that he used for his experiments the dog-flea (*Ctenocephalus canis*); the possibility is, therefore, to be reckoned with that this species of flea may not be so suited for the transmission of the rat-trypanosome by the inoculative method as the common rat-flea (*Ceratophyllus fasciatus*) which we have always used in our experiments.

In order to test this question, namely, whether the trypanosome passes into the rat through the proboscis of the flea or not, we are carrying on some experiments which up to the present have not given decisive results. The first step is to obtain single fleas known to be infective, since previous experiments have established that, of fleas taken at hazard from the infected breeding-cage, only about one in five or six, on the average, is infective. To obtain this preliminary result, a number of clean healthy rats are placed singly in suitable receptacles and on each rat one flea from the infected breeding-cage. The rats are then kept under observation and their blood examined at intervals, to see if any of them become infected by their respective fleas. Sometimes after a month's waiting no infection takes place, and we have to begin all over again; sometimes one or two rats out of a dozen or so become infected, indicating that the fleas put on these rats were truly infective. Then the fleas that produced infection are recovered from the rats they infected and put aside for further experiment; they may be referred to briefly as "known-infective fleas."

The actual experiment consists in feeding a known-infective flea on a healthy, non-infected rat. The flea, kept in a test-tube until it is properly hungry, is put on to a shaved area of the rat's skin by inverting the test-tube on to it, keeping the rim of the tube pressed down at first on the skin. The flea at first runs round and round within the glass circle, but generally soon comes to a standstill and begins to feed. As soon as it is engrossed in this occupation the test-tube can be lifted off and the process of feeding can be watched with a hand-lens; it is easy to see the blood passing up into the stomach of the flea. The chief thing is to watch whether any defæcation by the flea takes place; if this occurs, the fæces are at once washed off the rat's skin and the spot is disinfected so as to prevent any infection of the rat by the fæces of the flea. In our experience, however, it is rare for the flea to defæcate during the act of feeding. As soon as the flea withdraws its proboscis from the skin and becomes restless again it is recaptured and returned to its prison cell until the next occasion for repeating the experiment.

Such is the method of these experiments, which are now in progress, but unfortunately we have as yet no positive results to report. These experiments consume, as will be apparent from the description, much time and patience, and are very fruitful of disappointments, especially in the preliminary stage of obtaining known-infective fleas. Frequently none of the fleas taken from the breeding-cage turn out to be infective; or when an infection has been produced, the flea that produced it cannot be found; or when the flea has been recovered and lodged in its test-tube it dies incontinently; or when put on a clean rat it refuses to feed. Our experience has brought out one point very strongly, namely, that the weather, and especially the temperature, has a very great influence on the feeding of the fleas; a cold snap during the summer months puts them all off their feed, and during the coldest winter months it is almost useless to attempt to carry on these experiments. We also had an annoying set-back in the early part of the present year through our strain of the trypanosome dying out in our flea-breeding cages, so that a considerable delay was caused by having to procure a fresh strain and re-infect all our fleas.

The position may be summed up at present by saying that we still believe that the trypanosome passes into the rat through the proboscis of the flea, although we have not as yet succeeded in proving this satisfactorily, but are in hopes of being able to do so.

In addition to this, which may be called the main problem of the transmission, we have performed some experiments to test some subsidiary problems.

In my last report (p. 75) I gave an account of a series of experiments which showed, amongst other things, that "when the trypanosomes are undergoing development in the flea, they become changed in their properties in such a way that they are no longer capable of infecting the rat when injected into its blood." In the experiments then cited the trypanosomes were shown to have lost their infectivity by inoculation as early as forty-eight hours after having been taken up by the flea.

We have now made a number of experiments to test this point further and to determine how soon the trypanosomes undergo this change in their physiological properties after having been taken up by the flea from the blood of the rat. The method of experiment, in brief, is to feed fleas on an infected rat, and then to dissect these fleas at definite periods of time subsequently; the stomach is examined under the microscope and if living active trypanosomes are seen in it, it is injected into a healthy rat. At first we began with longer intervals, such as 36, 24, or 12 hours, approximately, after the fleas had taken up the trypanosomes; but since in every case no infection resulted, we experimented with much shorter intervals and found that little over half an hour was sufficient for the trypanosomes to lose their infectivity in the flea. Thus, in one such experiment an infected rat A was taken, and a small quantity of its blood injected into a control rat B. Then three fleas were taken from the infected breeding-cage and fed on rat A, under observation in the manner described above. The feeding was watched under a lens, and the exact moment noted at which blood began to pass up into the flea's stomach. Then each flea was caught and dissected, its stomach seen under the microscope to be swarming with active trypanosomes, and the stomach contents inoculated into another healthy rat, C, exactly 35 minutes after the flea had fed. Result : rat B, inoculated with trypanosomes directly from rat A, became infected in the normal manner; rat C, inoculated with trypanosomes from rat A after they had been 35 minutes in the stomachs of the three fleas, did not become infected. We hope to repeat and extend these rather remarkable results.

We have also done some experiments to find out whether starvation of the flea, after it has taken up trypanosomes from the infected rat, has any retarding effect upon the developmental cycle of the trypanosomes in the flea. So far as our experiments have gone, they tend to show that starvation of the flea has no influence whatever upon the development of the trypanosome, so long as the flea does not succumb to it.

(b) *Development.*—The results of many experiments all tend to show that, of fleas fed always on an infected rat, only about one in five or one in six, on the average, becomes infective; in other words, even when fleas are exposed to the maximum degree of infection, the trypanosomes only succeed in establishing themselves and going through their full developmental cycle in a relatively small percentage of the fleas. About 80-84 per cent. of the fleas possess a natural immunity to the trypanosomes, and, even if fed on blood containing vast numbers of the parasites, no development takes place, but the trypanosomes disappear completely from the digestive tract of the flea.

If, however, a number of fleas are fed on a well-infected rat, and are then dissected and examined about twenty-four hours after feeding, every flea will be found, as a rule, to contain trypanosomes in greater or less abundance in its digestive tract. It follows, however, from the experimental results just mentioned, that in at least four out of five such fleas the trypanosomes are destined to disappear and die out. The fact that trypanosomes are nearly always present in the gut of the flea twenty-four hours after an infective feed shows that the dying out of the trypanosomes in some 80 per cent. of the fleas is a gradual process. This conclusion is fully confirmed by the examination of fleas at later periods after an infective feed. Two days after feeding developmental stages of trypanosomes are found only in a much smaller percentage of the fleas, and after three days the percentage of fleas containing such stages is practically the same as that which is proved by the results of experiment to become permanently infective.

The conclusion that may be drawn from these data of observation and experiment combined is that in a majority of cases the trypanosomes taken up by a flea from a rat are destined not to develop but to degenerate and disappear gradually. Probably a certain number of trypanosomes degenerate in almost every flea, for even in fleas which have been proved by direct experiment to be infective the trypanosomes are often found to be exceedingly scarce in the digestive tract; speaking broadly, we can distinguish in such fleas scanty and swarming infections, the latter being but rarely met with.

In studying the early phases of the development of the trypanosome in the flea, we have, therefore, to distinguish clearly between two series of stages : a true *developmental* series, which leads to the trypanosome establishing itself in the flea and rendering it ultimately infective to the rat; and a *degenerative* series, in which the trypanosomes gradually degenerate, die off, and disappear from the gut of the flea. Forms

of the degenerative series are probably to be found in every flea during the first three days after an infective feed; forms of the true developmental series are only to be found in a small percentage of the fleas fed on infected rats.

In our earlier studies of the development of the trypanosome in the flea we had not recognised clearly the necessity for distinguishing between the degenerative and developmental series of stages, and were led consequently to rank certain forms of the parasite as developmental which we now know to be degenerative. We have now made a careful study of the degenerative series, and have thereby purified, so to speak, our notions with regard to the true development of the parasite by eliminating from the developmental series forms which do not belong to it.

If the flea takes a moderate feed of blood, it only fills its stomach; if, however, it gorges itself, as happens frequently, especially in the case of female fleas, the ingested blood not only fills its stomach but overflows, as it were, and passes on into the intestine and rectum. Hence, by the mere act of feeding the trypanosomes may be carried passively only into the stomach, or into the intestine and rectum as well. Degenerative forms of the trypanosomes are to be found both in the stomach and rectum, but are more common in the rectum. Even when the flea only fills its stomach with blood, the greater number of the trypanosomes pass on into the rectum and undergo degeneration in that organ. As a rule, only the first stages of the degeneration are to be found in the stomach while the most advanced stages are found abundantly in the rectum. Occasionally, however, advanced stages of degeneration are met with in the stomach, especially towards its pyloric end.

The process of degeneration is in the main as follows :—The trypanosomes taken in from the blood of the rat, which are fairly uniform in size, begin to diminish in all their dimensions, but especially in length; they appear to be wasting away and gradually dwindling in size. It is characteristic of such forms for the kinetonucleus to stay at the hinder end of the body, or even to become more approximated to the hinder end than is the case in the blood-form of the trypanosome which was the starting point of the development. The trophonucleus, on the other hand, tends to travel backwards and become approximated to the kinetonucleus; but this approximation is not, perhaps, an active process but merely the mechanical result of the wasting and dwindling of the anterior end of the body. During this process the flagellum becomes converted progressively at its anterior end into a fluffy mass, which stains blue or bluish with the Romanowsky stain, instead of the normal red. In this way dwarf forms of the trypanosome are produced, in which the body is finally so reduced in size that the two nuclei are of necessity in close contact, the kinetonucleus always, however, behind the trophonucleus; the flagellum varies in length, but often scarcely projects beyond the anterior broader extremity of the little pear-shaped or carrot-shaped body. In the most advanced stages of degeneration recognised by us the flagellum has disappeared altogether, and the body has become a little rounded mass with two nuclei; such forms probably undergo granular disintegration, and break up altogether.

The degenerative forms are to be found, as I have stated above, chiefly in the rectum, and are especially abundant eighteen or twenty-four hours after the flea has fed on an infected rat. All the forms found in the rectum earlier than about twenty-four hours are to be reckoned as degenerative, since the true developmental forms of the trypanosome do not reach the rectum until later. The degenerative stages, whether in the stomach or rectum, show a great tendency to attach themselves by the extremity of the flagellum; they occur commonly in the rectum in large clumps or masses simulating the rectal crithidias of a later stage of the true developmental series; they can be recognised, however, when seen in the living state, by the pear-shaped or conical body which is attached by its broader extremity, while the free end tapers to a sharp point. Such a body represents, in fact, simply the hinder end of the original blood-trypanosome, dwindled away and reduced to the pointed posterior extremity. The crithidial forms of the true developmental series, on the other hand, are typically pear-shaped forms attached by the narrower end, and with the free extremity of the body rounded. It may, nevertheless, be a matter of some difficulty, in some cases, to distinguish with certainty between degenerative and developmental forms in the living state. In permanent preparations, however, the degenerative forms always have the kinetonucleus posterior to the trophonucleus, while in the developmental forms the reverse is usually found; and the degenerative forms show no sign of multiplication, while the developmental forms are multiplying more or less actively.

The true developmental series contrasts in all its features with the degenerative series. To begin with, it is confined at first to the stomach of the flea entirely; our observations tend to show that no developmental forms pass down into the rectum for about twenty-four hours. It is convenient, therefore, to divide the developmental series into a stomach phase and a rectal phase.

In the stomach phase the trypanosomes increase considerably in size, becoming often very much larger than the blood-forms taken in originally. At the same time there is a tendency, more or less pronounced in different individuals, for the kinetonucleus to travel forwards from the hinder end of the body and for the trophonucleus, on the other hand, to travel backwards—displacements which can only be explained as due to active migration on the part of the nuclei concerned, and not as the result of any mechanical conditions. But the great feature of the stomach phase is that the trypanosomes, whether modified in size and structure or not, penetrate into the epithelial cells lining the stomach, and there undergo a process of multiplication by multiple fission. No multiplication of the trypanosomes takes place in the stomach except within the epithelial cells. We have found these intracellular phases as early as eight hours, as late as four days, after the infective feed; there can be no doubt, therefore, that many successive generations of such multiplication take place in the stomach; apparently, under natural conditions, the intracellular multiplication may go on continually for about three days, but is often of much shorter duration.

The daughter-trypanosomes produced by the process of intracellular multiplication are of the stomach-type described above, that is to say, as large as, or more usually larger than, the original blood-forms, and with the two nuclei approximated more or less closely to one another. As time goes on, the approximation of the nuclei appears to be increased in the successive generations of trypanosomes produced, until three days after feeding a very large crithidial type is found in the stomach, that is to say, a long, very active form in which the kinetonucleus is actually in front of the trophonucleus. Such forms have been found by us in some fleas examined three days after their first feed and not re-fed. On the other hand, in other fleas treated in a precisely similar manner, the abundant trypanosomes in the stomach are not crithidial in structure, but still have the kinetonucleus well behind the trophonucleus. It is at present a puzzle to us why this crithidial modification of the structure should have taken place in some cases and not in others. We are inclined to suspect that a process of sexual conjugation may take place in some cases at this stage, and that the difference in the forms produced may be related in some way to this process; but at present we have no definite proof of this supposition.

In any case the final product of the stomach phase is a long, active trypanosome with the two nuclei more or less approximated or even with the kinetonucleus in front of the trophonucleus. Seen in the living state this form differs markedly from the original blood-form; the body appears stiffer, without the sinuous curves characteristic of the blood form, and in progression the animal travels with the flagellum forward and the body held straight and stiff; there is a tendency, often very marked, for the hinder end of the body to be swollen or club-shaped. Thus these forms appear very crithidial in appearance when seen in the living state, even when not at all crithidial in their structure, that is to say, in the position of the nuclei and extent of the undulating membrane. It is these forms which pass down the intestine into the rectum and initiate the rectal phase; we have twice been so fortunate as to see them in the act of migration down in the intestine in great numbers, carried down in beads of fluid fæcal matter propelled by the peristaltic action of the intestine itself.

The initial forms of the rectal phase, described above, when they reach the rectum become sluggish in movement with a pronounced tendency to attach themselves by the tip of the flagellum to firm objects—under natural conditions, to the wall of the rectum, but when dissected out, to the slide or coverslip or to any débris. The body becomes more thickened towards the hinder end, giving them a tadpole-like appearance. Apparently these "tadpoles," after attaching themselves to the wall of the rectum, multiply actively by simple binary fission, becoming progressively smaller in size as they do so, and at the same time the nuclei become displaced into the typical crithidial arrangement, if they have not already assumed this arrangement at a previous stage. In this way are produced the little pear-shaped crithidias which constitute the typical rectal phase; the exact method, however, in which the rectal crithidias originate from the "tadpoles" is still a somewhat obscure point to us.

In any case the principal form of the rectal phase is a little pear-shaped crithidial form, attached often in vast numbers to the wall of the rectum, multiplying there by binary fission, and so keeping up a stock of the parasite, which maintains its existence probably as long as the flea lives. From time to time, however, individual crithidias cease to multiply and become transformed into the little stumpy trypanosome-forms which are the final form of the development, and which pass, in some way yet to be thoroughly explained, into the blood of the rat, and thus produce a fresh infection. This development, which cannot be made perfectly clear without numerous figures, will form, we hope, the subject of a complete monograph by us as soon as we have succeeded in elucidating those points upon which we are not at present perfectly clear in our minds.

2. *Teaching work.*—In the months of January, February, and March of this year I gave a course of thirteen lectures upon the Hæmoflagellates. The lectures were given at the Lister Institute on Tuesdays and Fridays at 5 p.m., and each lecture was followed by a demonstration of microscopical preparations illustrative of the subject of the lecture. In some parts of the subject, especially in those relating to the transmission and development of trypanosomes, the lectures touched new ground, and I think I may say that the series of preparations by which they were illustrated was quite unique. The attendance, which remained very uniform through the whole course, was between 25 and 30. The subject-matter of this course will form, I hope, the material for a book which I have undertaken to write for Macmillan and Co.; I am only waiting for Dr. Thomson and myself to complete our researches upon the development and transmission of *Trypanosoma lewisi* before I start upon this book.

A number of workers have occupied places in my laboratory during the past year and have received informal assistance or instruction from me or my assistants.

Dr. J. D. Thomson has been collaborating with me in researches on *Trypanosoma lewisi*, as already stated.

Dr. W. Cecil Bosanquet has been occupying his rather scanty leisure from professional duties by working in my laboratory upon various protozoa. He is at present studying the coccidiosis of cattle in British East Africa upon material sent him by Dr. R. E. Montgomery.

Mr. J. S. Dunkerly, who has occupied a place in my laboratory during the past two years, has obtained the post of lecturer on protozoology in the Natural History Department in the University of Glasgow, and left us in October last to take up his new work.

Mr. J. J. Valladares worked here from the beginning of October, 1911, to February, 1912; he was occupied in studying protozoa generally, and making himself acquainted with technical methods.

Dr. Arrigo Visentini, of Rome, occupied a place in the laboratory from the beginning of December, 1911, to July, 1912. He was engaged chiefly in investigations upon the cultural forms of the parasite of infantile "kala-azar," making use of material which he brought from Sicily and Calabria. He completed two memoirs, which have been communicated to the Quarterly Journal of Microscopical Science, and are at present in the press; the one dealing with the cytological structure of the flagellated forms of the parasite, the other with the mechanism of the immunity against inoculation with cultural forms possessed by the guinea-pig.

Major Powell, I.M.S., came to the laboratory in June with the view of increasing his general knowledge of protozoa and of studying methods of technique.

Mr. C. H. Martin has visited the laboratory at different times for short periods; he came here in May to put the finishing touches to an interesting memoir which he has published (No. 10 below) on the protozoa of sick soils, and in particular on the life-history of a flagellate found by him in such soils.

Miss Pixell, Demonstrator of Zoology at Bedford College, has been working at various protozoa parasitic in marine animals whenever she has found leisure to do so.

Mr. W. F. Lanchester and Mr. R. Kirkpatrick (of the British Museum of Natural History) have continued to work in the laboratory from time to time.

I have, as in former years, been frequently in correspondence with various people in this country, the Colonies or abroad, who have consulted me about protozoological problems or particular species of protozoa in which they were interested,

such correspondence involving in many cases the examining and reporting upon specimens sent to me.

Appended will be found a report by my assistant, Dr. H. M. Woodcock, and a list of works published from this Department during the year covered by this report.

E. A. MINCHIN.

REPORT BY H. M. WOODCOCK, D.Sc. (Lond.), Assistant to the University Professor of Protozoology, for the Year ending June 30th, 1912.

My work during the year ending June 30th last consisted of (a) departmental work, and (b) research.

(a.) Professor Minchin gave his annual course of lectures in the early spring, from January to March, and during this period a considerable portion of my time was taken up in arranging the demonstrations in connection with them. The subject was the interesting and highly-important one of the Hæmoflagellates and allied forms, and I think I may say, merely with regard to the preparations shown, that these would be difficult to excel, including as they did, for instance, series of the remarkable developmental forms made known by Minchin and Thomson for *Trypanosoma lewisi* in the rat-flea, and again, those of piscine trypanosomes in leeches, worked out by Miss Robertson, thus illustrating fully the two types of life-cycle of these parasites in the invertebrate host most completely known up to the present. I have also assisted in the general routine work of the laboratory throughout the year and given help to various workers.

(b.) *Research.*—I have continued my study of the blood-parasites of birds. The work done has dealt chiefly with two aspects of the subject. During the warmer months I continued my endeavours to ascertain the manner in which the transmission of the parasites occurring in common British birds, such as the chaffinch, is effected. This investigation is proving extremely difficult and laborious, and so far, unfortunately, I have been unable to obtain any light upon the matter. I may indicate, perhaps, the attempts which I have made. As regards the trypanosomes, I have as yet no reason to alter my opinion that mosquitoes (of the genus *Culex*) constitute the invertebrate host. The fact that I have obtained certain characteristic developmental phases of *T. noctuæ* of the little owl, in *Culex pipiens*, which I am strongly inclined to consider are the transmissive forms, renders it not unlikely that mosquitoes transmit the trypanosomes of other birds, *e.g.*, of the chaffinch. But I have not yet been able to obtain even that amount of evidence in the case of *T. fringillinarum*. The drought of last summer was very much against the mosquitoes, and I was unable to procure a sufficient number with which to perform experiments until about the middle of August. It so happened, most unfortunately, that I then had no birds infected with trypanosomes. Just in the summer time, when the mosquitoes come on, it is most difficult to obtain these small cage-birds. Two birds which were well infected not only with trypanosomes and halteridia, but which also had the much rarer parasite, *Leucocytozoon fringillinarum*, had died about the end of June, after I had kept them alive for nearly four months. (It was one of these birds which showed the unusual condition in *Halteridium*, noted in my last report, *vide* [Cd. 6024]). I was able to obtain two or three birds which were infected with *Halteridium*, but these parasites were only scanty in number. While the hot weather continued, during August and the first three weeks of September, I succeeded in getting the *Culex* to feed on the chaffinches, which was, at any rate, an advance upon my earlier experiments (*vide* [Cd. 4476]). For some reason or other, however, they would not feed with nearly as much readiness as those with which I worked at Rovigno although they were kept in very similar cages. My largest cage contained from about sixty to eighty female mosquitoes, at different times, in addition to males, which were, if anything, more numerous. I never found more than five had fed on the bird during any one night period, *e.g.*, including dusk and dawn, and usually only two or three; this was a much smaller proportion than I found at Rovigno. I do not think the different bird used (a chaffinch instead of an owl) was mainly responsible, although the chaffinch lacks the large fleshy pad, in the neighbourhood of the nostrils, which is a favourite spot for feeding in the case of the little owl. On one occasion, I left an owl which I had brought back with me from Rovigno (unfortunately uninfected) in the cage and six *Culex* fed on it. I may recall that Ross, in his celebrated work on the malarial parasites (*Proteosoma*) of birds in India, used

sparrows to a large extent, and got the *Culex* to feed readily on them. Thinking that possibly the dry and dusty atmosphere of a London laboratory may perhaps be partly the cause of the disinclination of the mosquitoes to feed, I intend to conduct my next experiments during the forthcoming summer (if the weather will only prove suitable) in my own garden.

As regards *Halteridium*, I was never able to find any ookinetes in the stomach-contents of mosquitoes which fed on infected chaffinches; of course, this may have been due to the infrequent occurrence of these parasites in the blood of the birds, rendering fertilization more difficult. It is generally assumed, however, that *Culex* is not a true alternate host for *Halteridium*; thus Ross states that while the *Proteosoma* developed in these mosquitoes, he never saw anything to indicate that *Halteridium* also did. Again, Aragao has found that a Hippoboscid fly (*Lynchia*) is the alternate host of the *Halteridium* of pigeons. Nevertheless, I do not feel sure yet that *Culex* also will not serve as a true host. On two occasions I obtained a well-marked development of typical ookinetes in *Culex* which had fed on an owl with a good infection of *Halteridium* at Rovigno; and as Aragao never found any stage later than the typical ookinete in his infective Lynchias, I do not see why those which were developed in *Culex* should not have proved infective. During the spring and early summer of the present year, however, I have been collecting bird-fleas, with a view to seeing whether these act as the alternate host of *H. fringillæ.* In response to requests and advertisements, I obtained several nests, mostly of house-sparrows, but also a few of chaffinches. Most of the nests, when these had been only recently vacated by the birds, yielded a few fleas, and in one or two they were quite numerous, amounting to a score or so. I am trying to get a " breeding-cage " constituted, which will furnish a stock of fleas, but up to the present I have not succeeded in getting one that looks like starting. It is obviously impossible to imitate exactly the conditions prevailing in a nest, where the nestlings provide the chief source of food for the fleas, besides being unable to retaliate by snapping up the fleas at every opportunity, as do the adult birds, with disastrous results to the flea " colony." In nearly every case, the bird-flea which I have found in the nests is *Ceratophyllus gallinæ*, which is a very cosmopolitan species, being found in the nests of many different birds. Occasionally also I have met with *C. gallinulæ*, but I am working almost solely with the former species. I have not once come across the special finch-flea, *C. fringillæ*, either in sparrow or chaffinch nests, although it is known to occur in both. If a bird-flea does act as the host and transmissive agent of *Halteridium fringillæ*, I think it is quite likely that *C. gallinæ* will do so (probably, of course, *C. fringillæ* as well), since this species is evidently quite common in finch nests (including the house-sparrow). This view is supported by the recent discovery of Nöller that the dog-flea (*Ctenocephalus canis*) can act as the true host of the *Trypanosoma lewisi*, and permit of the same remarkable intracellular development of the parasites to be undergone, as in the rat-flea (*Ceratophyllus fasciatus*) itself, although the dog-flea belongs not only to a distinct species but to a different genus. It is becoming evident, in fact, that the rôle of true host and transmissive agent, in which a cyclical development of the parasites occurs, is not by any means restricted to one particular insect. And these remarks will apply, of course, equally to the Avian blood-parasites.

The above is a record of attempts, and not, unfortunately, of results. I intend, however, to persevere, as I have opportunity, with the subject. Whereas many workers are or have been engaged in the study of the transmission and development in the invertebrate host of the blood-parasites (especially the trypanosomes) of other vertebrates, scarcely any one, so far as I am aware, is occupied with a similar study in the case of the Avian forms, which is, however, just as interesting from a protozoological standpoint.

During the winter months I was studying the cytology of the intracellular parasites (*Halteridium* and *Leucocytozoon*) of the little owl and also of *Halteridium fringillæ*, with special reference to the nuclear structure, as it is seen in preparations fixed and stained by the best cytological methods. I was led to pay renewed attention to this question as a result of the study of some preparations of the Hæmogregarine, *Karyolysus lacertæ*, from the common wall-lizard (*Lacerta muralis*), which I had made while at Rovigno. A memoir dealing with these cytological points will shortly appear in the Quarterly Journal of Microscopical Science. The subject is of considerable importance in connection with the much-discussed view of a relationship between the intracellular parasites of birds (*e.g.*, of the little owl) and the trypanosomes occurring in the same hosts.

I may give here a summary of my paper, which is in the form of three "Notes on Sporozoa" (Nos. II.-IV.). In the first (No. II.), I describe the different phases of *K. lacertæ*, which occurred in the lizards I examined, and their effects upon the host-cells (red blood-corpuscles). Two chief forms were found, which appear so distinct that, at first sight, it might be thought they belonged to different species. Nevertheless, they represent really early, younger phases, and rather later, older forms of one and the same parasite. The two types are distinguished most readily by the position of the nucleus, but they also differ, as a rule, in size. In the first type of parasite, which is the smaller, the nucleus is situated about the middle of the body; in the second type, which is larger, the nucleus lies usually near one end. A very important feature is shown in the nuclear structure of the younger forms, namely, the presence of a conspicuous, deeply-staining karyosome, placed excentrically, at one end of the nucleus. In a slightly later phase, this karyosome is divided into two portions, one of which is generally larger than the other. One portion (usually the smaller half) becomes apparently sub-divided up amongst the general nuclear material, while the other takes no further share in the nuclear development, but is eliminated, passing to the outside of the cytoplasm and gradually losing its staining character. In the older phase of the parasites there is (typically) no sign of a karyosome present. Now and again, however, a small, central granule in the nucleus is clearly seen; this I regard as a centrosome (centriole). I conclude this section by discussing the other Hæmogregarines of *Lacerta* spp., which have been hitherto described, and consider that many of the species which have been distinguished by other workers are not distinct and independent forms, but merely phases of *Karyolysus* (*Hæmogregarina*) *lacertæ* (Danil.). In my opinion the practice is far too prevalent of making every different phase or variety of form of a blood parasite described a new species; this has led in some cases to four or five so-called species being named from one and the same host.

In my second Note (No. III.) I compare in detail the nuclear structure of *Karyolysus lacertæ* with that which is found in certain Coccidia and certain other Hæmogregarines. The karyosomatic condition occurring in the young forms of *K. lacertæ* resembles closely the nuclear condition seen in the very young schizonts of a Coccidian which was formerly regarded as belonging to the life-cycle of *Adelea ovata*, but is now considered to be a phase of another form, *Barrouxia alpina*. Further, a close comparison can be made between the behaviour of the karyosome in early phases of the lizard Hæmogregarine, and in the case of this Coccidian and also others. This fact furnishes additional evidence of the close affinity and phylogenetic relationship of the Hæmogregarines and the Coccidia. Among the Hæmogregarines themselves, *K. lacertæ* provides an interesting intermediate form (in respect of the presence of a karyosome in the early phases) between the Coccidia and other Hæmogregarines, such as those of tortoises (*H. nicoriæ*, Miss Robertson, and *H. stepanovi*), in which a true karyosome is lacking altogether. I discuss the significance in this connection of the nucleolus—a true nucleolus, *i.e.*, a plastin element—described by Reichenow in the case of *H. stepanovi*, and criticise the position taken up by this worker with regard to the presence of an intranuclear (or intrakaryosomatic) division-centre.

My third Note (No. IV.). deals with the nuclear structure of *Leucocytozoon ziemanni* and *Halteridium noctuæ*, the intracellular parasites of the little owl. I have been able to satisfy myself at length, and, I think, to show clearly, that the characteristic nuclear element which is frequently distinctly outside, and at times quite apart from the main nuclear mass, corresponds to and represents the karyosome of certain Hæmogregarines (*e.g.*, *Karyolysus lacertæ*) and of the Coccidia. This body has been hitherto considered by many workers (including myself), and is still regarded by members of a prominent German school, as representing a kinetonuclear element, and thus supporting the famous view originally propounded by Schaudinn that the Hæmosporidia are intimately connected with the Hæmoflagellates of the binucleate type. I think that Minchin and myself, in our paper on the parasites (especially the trypanosomes) of the little owl, referred to in the last report (*vide* [Cd. 6024]), showed, so far as it was possible to prove any conclusion partly upon negative evidence, that there is no actual ontogenetic connection between the intracellular parasites and the trypanosomes. When to this are added the observations I have made in this Note, which have caused me to relinquish entirely the view that any of the above-mentioned Hæmosporidia possess a kinetonuclear element, it must be admitted that no evidence of any kind remains in support of Schaudinn's view. The presence of a karyosome in connection with the nucleus of *Leucocytozoon* and *Halteridium* is

another indication, on the contrary, of the essential Coccidian affinities and relationships of these parasites. The ground is now clear, therefore, for ascertaining the real manner in which the independent development of the various blood-parasites of birds does take place in their respective alternate hosts.

I may add that Professor Nuttall, of Cambridge, kindly supplied me with material of *Piroplasma canis*, from which I made preparations with a view to seeing if the nucleus of this Hæmosporidian is also of the karyosomatic type. I expect to find this will be the case, more especially as a paper has recently been published by Schuberg and Reichenow on the nuclear structure of this parasite, in which they come to the same conclusion.

H. M. Woodcock.

List of Works published from the University Department of Protozoology.

By Professor E. A. Minchin :—

(1) An Introduction to the Study of the Protozoa, with Special Reference to the Parasitic Forms. *London* (*Edward Arnold*), 1912, pp. xii. + 517, 194 illustrations in the text.

(2) Speculations with regard to the Simplest Forms of Life and their Origin on the Earth. (Presidential Address) *Journal of the Quekett Microscopical Club*, Series 2, Vol. XI., pp. 339-364.

(With Dr. Woodcock.)—

(3) Observations on the Trypanosomes of the Little Owl (*Athene noctua*), with Remarks on the other Protozoan Blood-Parasites occurring in this Bird. *Quarterly Journal of Microscopical Science*, Vol. LVII., pp. 141-185, pls. xx., xxi., 1 text fig. (*Vide* Cd. 6024, p. 78.)

By Dr. H. M. Woodcock :—

(4) On an unusual Condition observed in *Halteridium. Zoologischer Anzeiger*, Vol. XXXVIII., pp. 465-471, with 22 text figs.

(5) Protozoa. *Zoological Record for 1910*, Vol. XLVII., 1911.

(*See* also No. 3.)

By Miss Muriel Robertson :—

(6) The Division of the Collar-Cells of the Calcarea Heterocœla. *Quarterly Journal of Microscopical Science*, Vol. LVII., pp. 129-138, pl. xix. (*Vide* Cd. 5514, p. 27.)

By Mr. J. S. Dunkerly :—

(7) On the Occurrence of *Thelohania* and *Prowazekia* in Anthomyid Flies. *Centralblatt für Bakteriologie, Parasitenkunde*, &c. (*I. Abt. Orig.*), Vol. LXII., pp. 136-140, 1 pl.

By Major W. Glen Liston and Mr. C. H. Martin :—

(8) Contributions to the Study of Pathogenic Amœbæ from Bombay. *Quarterly Journal of Microscopical Science*, Vol. LVII., pp. 107-128, pls. xvi.-xviii. (*Vide* Cd. 6024, p. 77.)

By Mr. C. H. Martin :—

(9) A Note on the Early Stages of Nuclear Division of the Large Amœba from Liver Abscesses. *T. c.*, pp. 279-281, 7 text figs.

(10) A Note on Protozoa from Sick Soils, with Some Account of the Life-Cycle of a Flagellate Monad. *Proceedings of the Royal Society*, Series B, Vol. LXXXV., pp. 393-400, pl. x.

APPENDIX III.

Report by Professor G. H. F. Nuttall, F.R.S., on the work of the Quick Laboratory, Cambridge.

The appended list of papers published by workers in the Quick Laboratory indicates the scope of the investigations conducted during the year.

The following workers, besides myself, have been engaged in research throughout the year :—Mr. C. Warburton, M.A. (Demonstrator in Medical Entomology); E. Hindle, Ph.D. (Beit Memorial Fellow for Medical Research); Mr. G. Merriman (Trinity Hall, Student in Medical Entomology).

Mr. C. Strickland, M.A., B.C., lately Assistant to the Quick Professor, has been appointed Travelling Medical Entomologist to the Federated Malay States Government. Upon his departure in April Dr. Hindle acted as Assistant temporarily, and Mr. K. R. Lewin, B.A. (Trinity College), at present engaged in research in the laboratory, has been appointed to the Assistantship.

Mr. G. Merriman, having resigned the studentship he has held until the commencement of the term, is about to proceed to India, and Mr. N. Cunliffe, B.A. (Trinity College) has been appointed this term to fill the studentship in Medical Entomology.

The following have been engaged in research in the laboratory for shorter periods of time :—Major J. W. Cornwall, M.D., I.M.S., of Madras (6 months); G. L. Tuck (otherwise Wu Lien Teh), M.D., of the Army Medical College, Tientsin, China; Mr. R. C. Lewis, M.A., Cape Colony, 1851 Exhibition Scholar; Miss Annie Porter, D.Sc. (Lond.); and Miss Jordan Lloyd (Newnham College).

Major S. R. Christophers, M.B., I.M.S., Superintendent of the King Institute of Preventive Medicine, Madras, has recently come to the laboratory to continue researches commenced in India.

My own work has been in continuation of that described in last year's report (see p. 84). Several papers on pathogenic protozoa and on ticks are being prepared for the Press. In September I attended the XVth. International Congress of Hygiene and Demography in Washington, D.C., as delegate of the India Office and of the University of Cambridge. I presented a paper to the Congress, which will appear in the proceedings. In addition, I gave several lectures whilst in the United States : the Herter Lectures at the Johns Hopkins University, Baltimore; the Weir Mitchell Lecture at the College of Physicians, Philadelphia; a Harvey Lecture at the Academy of Medicine, New York: and delivered addresses before the American Philosophical Society, Philadelphia; to medical students at Harvard, and at the University of Pennsylvania. Through the courtesy of Dr. C. W. Stiles, of the Rockefeller Sanitary Commission for the Eradication of the Hookworm Disease, I was given a very favourable opportunity of visiting places in North Carolina where ankylostomiasis is rampant amongst the whites. I shall take an early opportunity of reporting upon the work of the Commission and upon the conditions I observed in the affected country. My published papers for 1912 deal with pathogenic protozoa and ticks.

Mr. Warburton and myself are continuing our systematic work on ticks in connection with the monograph we have partly published, and Mr. Warburton is describing a number of new species which have reached us from various parts of the world. Mr. Strickland described a new gregarine in rat-fleas, and has prepared a report upon his studies into the biology of rat-fleas. Dr. Hindle has devoted much attention to the study of *Spirochœta gallinarum*, and traced out its development in *Argas persicus*. Dr. Hindle and Mr. Merriman have carried out interesting experiments upon the biology of house flies and ticks which will soon be published. Major Cornwall's investigations have dealt with the phenomena of hæmolysis. Messrs. Lewin and Cunliffe are at present actively engaged in research in protozoology and parasitology.

In view of the continued activity of the workers in the laboratory, and the results attained, I trust that the Tropical Diseases Research Fund Committee will renew the grant allowed last year to the Quick Laboratory. Owing to the increasing expenditure of the laboratory I beg that a grant of £350 be made for the ensuing year, the same to be expended as follows :—£100 to be paid in respect to the research

studentship in medical entomology; £100 for the Assistantship; £50 for the salary of a Consulting Entomologist; £100 to aid in defraying the general expenses of the Quick Laboratory.

GEORGE H. F. NUTTALL.

Cambridge,
18 November, 1912.

LIST OF PUBLICATIONS FOR THE YEAR 1912.

(1) Nuttall, G. H. F. (1911): The adaptation of Ticks to the habits of their Host. *Proc. Cambr. Philos. Soc.*, XVI., 189-190.

(2) Hindle, E. (XII., 1911): On the life-cycle of *Spirochæta gallinarum*. Preliminary Note. *Parasitology*, IV., 463-477, 5 text-figures and 1 diagram.

(3) Copeman, S. M., Howlett, F. M., and Merriman, G. (XII., 1911). An Experimental Investigation on the Range of Flight of Flies. *Reports to the Local Government Board on Public Health and Medical Subjects*, N.S., No. 53, pp. 1-9, 1 map.

(4) Warburton, C. (II., 1912): Notes on the Genus *Rhipicephalus*, with the description of New Species, and the consideration of some Species hitherto described. *Parasitology*, V., 1-20, 12 text-figures.

(5) Nuttall, G. H. F. (II., 1912): Notes on Ticks, II. (1) New Species (*Amblyomma, Hæmaphysalis*); (2) *Ixodes putus*: Description of the hitherto unknown Larval Stage. *Parasitology*, V., 50-60, 9 text-figures.

(6) Nuttall, G. H. F. (II., 1912): Note on *Rossiella rossi* (Nuttall, 1910) occurring in the Jackal in British East Africa. *Parasitology*, V., 61-64.

(7) Nuttall, G. H. F. and Strickland, C. (II., 1912): On the occurrence of Two Species of Parasites in Equine "Piroplasmosis" or "Biliary Fever." *Parasitology*, V., 65-96, Plate III., 1 text-figure, 5 Charts and 8 Diagrams.

(8) Nuttall, G. H. F. (II., 1912): Russian Ixodoidea. (Remarks upon a paper by Yakimoff, Winogradoff, and Kohl-Yakimoff in this *Bulletin*, V., 39-41). *Bull. Soc. Pathol. Exotique*, V, 120-122.

(9) Hindle, E. (III., 1912): Attempts to transmit "Fowl Pest" by *Argas persicus*. *Bull. Soc. Pathol. Exotique*, V., 165-167.

(10) Hindle, E. (IV., 1912): The "Inheritance of Acquired Characters in Trypanosomes. *Science Progress*, 687-697.

(11) Hindle, E. (IV., 1912): The inheritance of Spirochætal Infection in *Argas persicus*. *Proc. Cambr. Philos. Soc.*, XVI., 460-461.

(12) Strickland, C. (IV., 1912): Gregarines in rat-fleas. *Proc. Cambr. Philos. Soc.*, XVI., 460-461.

(13) Strickland, C. (VI., 1912): *Agrippina bona* nov. gen. et nov. sp., representing a New Family of Gregarines. *Parasitology*, V., 97-108, Plate IV., 33 text-figures.

(14) Hindle, E. and Lewis, R. C. (VI., 1912): Note on "*Crithidia*" *cleti*, n. sp., parasitic in the Alimentary Canal of *Cletus varius* Dall. *Parasitology*, V., 109-113, 17 text-figures.

(15) Hindle, E. (VI., 1912): What is the Genus *Leptomonas* Kent? *Parasitology*, V., 128-134.

(16) Nuttall, G. H. F. (VI., 1912): In Memoriam: Adelchi Negri. *Parasitology*, V., 151-154, with Portrait, Plate VI.

(17) Hindle, E. and Merriman, G. (IX., 1912): The Sensory Perceptions of *Argas persicus* (Oken). *Parasitology*, V., 203-216, 8 text-figures.

(18) Fantham, H. B. and Porter, Miss A. (VII., 1912): The Structure and Homology of the Microsporidian Spore as seen in *Nosema apis*. *Proc. Cambr. Philos. Soc.*, XVI., 580-583, 1 text-figure.

(19) Cornwall, J. W. (X. 1912): On the Mean Lytic Point of Red Blood Corpuscles and the apparent Tonicity of Sheep Serum. *Journ. of Hygiene*, XII., 245-258, 5 Charts.

APPENDIX IV.

Reports from the London School of Tropical Medicine.

No. 1.

LONDON SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received May 31, 1912.)

London School of Tropical Medicine (University of London),
Royal Albert Dock, E., 31st May, 1912.

SIR,

I HAVE the honour to enclose herewith, for the information of the Advisory Committee of the Tropical Diseases Research Fund, the undermentioned reports of the special departments:—

Entomology, Colonel A. Alcock, I.M.S., F.R.S., F.Z.S., C.I.E.
Helminthology, R. T. Leiper, D.Sc., M.B., Ch. B., F.Z.S.
Protozoology, C. M. Wenyon, B.Sc., M.B., B.S.

During the period under review the number of students attending the special departments has been as follows:—

October to December Session, 1911, 16.
January to March Session, 1912, 17.

The total number of students attending the School during the October to December Session was 64, and during the January to March Session, 65.

It will be of interest to the Advisory Committee to know that steps are being taken to increase the laboratory accommodation for ordinary students to 100 benches and to provide additional sleeping accommodation for resident students.

Tropical research will benefit in the future by Lord Wandsworth's bequest. Sir William Bennett, to whom the sum of £10,000 was bequeathed for the purpose of medical research, has placed the amount at the disposal of the School.

I am, &c.,
P. MICHELLI,
Secretary.

Enclosure 1 in No. 1.

REPORT OF HELMINTHOLOGIST FOR THE HALF-YEAR ENDING 30TH APRIL, 1912.

SIR,

I HAVE the honour to submit my report for the half-year ending 30th April, 1912, and to forward copies of publications made during the period.

My time has been employed wholly in teaching and in research in the special subject for which I hold my appointment.

Teaching.

(*a*) The ordinary classes which form part of the "certificate" curriculum in tropical medicine were held in December and March.

(*b*) The course of practical instruction in veterinary helminthology for qualified veterinary surgeons was held in November and extended over a period of four weeks.

(*c*) An advanced course of Medical Helminthology, extending over three weeks, was held in March.

Research Workers.

(*a*) Dr. Andrew Connal, in addition to attending the advanced course in March, occupied a table in the Research Laboratory for one month, and prepared a report upon certain new helminthes collected by him in West Africa.

(*b*) Mr. Norman Hall, M.R.C.V.S., made a special study during February of a collection of parasites of the ostrich, preparatory to taking up a laboratory appointment in the Transvaal.

Reports, &c.

A less quantity of material than usual has been received for examination from officers in Government Services abroad. The arrangement, referred to in a previous

report, by which diagnoses of the nematode parasites collected at the Zoological Gardens, London, are made in return for the bulk of the material, has been renewed for the ensuing year.

The British Museum, The Royal College of Surgeons, The Entomological Research Committee of the Colonial Office, the Pathological Department of the University of Glasgow, a number of Fellows of the Zoological Society, and others, have submitted specimens for report.

Grant from the Board of Agriculture.

In March, the Committee of the Board of Agriculture administering moneys from the Development Fund for the promotion of Agricultural Research granted the Helminthological Department a sum of £100 for the incidental expenses of an investigation into Pulmonary Helminthiasis during the ensuing six months.

Publications.

The issue of the "Journal of the London School of Tropical Medicine" has added to the routine work of the Department, a special section of the Journal being devoted to the annotation of recent advances in Helminthology.

The following papers have been published from the laboratory during the six months ending 30th April, 1912:—

1. By myself:—
   (*a*) Check-list of New Genera and Species of Helminthes in 1911.
   (*b*) Notes of Recent and some New Records of Helminthes in Man.
   (*c*) Check-list of Helminthes Parasitic in Equines.
   (*d*) A New Echinostome Parasite in Man.
   (*e*) A Method for dealing with Town Wells infected with Guinea-worm.
   (*f*) Check-list of Helminthes Parasitic in Cattle.

2. By Dr. Adam Hutton, West African Medical Service:—
   (*g*) On the Morphology of Oxyuris Ambiguus, Rud. type of the Genus Passalurus.

I have, &c.,

ROBERT T. LEIPER.

Enclosure 2 in No. 1.

REPORT OF THE ENTOMOLOGIST FOR THE HALF-YEAR ENDING 30TH APRIL, 1912.

SIR,

I HAVE the honour to submit the customary report on the progress of my Department for the half-year ending 30th April, 1912, which includes two sessions of the School.

During these sessions I gave the usual courses, severally extending over three weeks, of lectures and demonstrations in Medical Entomology, and also the usual short courses dealing with Venomous Snakes. I also conducted two special courses, each of three weeks' duration, in Entomology, for officers deputed by His Majesty's Colonial Office, each of which was attended by fourteen officers.

Miss Sophia L. M. Summers, M.A., B.Sc., Carnegie Scholar of the University of Aberdeen, continued her work in my laboratory. She has critically examined a large number of blood-sucking flies and has prepared an "Epitome of the blood-sucking Muscidæ (*Glossina* excepted)," which will shortly be published in the School Journal.

My own time has been fully occupied in teaching, and in extending and improving the departmental museum: not only has the number of mounted specimens been considerably increased, but also the facilities for examining them—in the way of work-benches and microscopes—have been augmented.

From His Majesty's Secretary of State for India we have received another volume of the Fauna of British India; and to the Entomological Research Committee of His Majesty's Colonial Office we are indebted for a large number of blood-sucking insects of many kinds.

Our obligations must also be expressed to the following gentlemen, who have been at pains to send us material for the museum and for the practical class demonstrations :—

(*a*) *Africa:*—

Dr. H. E. Arbuckle, Dr. D. Burrows, Dr. G. G. Butler, Dr. H. S. Coghill, Dr. A. Connal, Mr. W. Eden, Dr. C. G. Grey, Dr. A. Hutton, Dr. H. Lobb, Dr. Pearson, Dr. Pollard, Dr. Snell, Dr. C. E. S. Watson, Dr. G Carpenter, Dr. R. E. Drake-Brockman, Dr. Van Someren, Dr. Henry Curtis, F.R.G.S., and Mr. H. S. Wellcome.

(*b*) *Asia:*—

Dr. N. Annandale, and the Trustees of the Indian Museum, and Dr. A. Carment, of Sarawak.

(*c*) *America:*—

Dr. H. Johnston, of Jamaica.

(*d*) *Europe:*—

Dr. H. Bayon, Professor R. T. Hewlett, and the Hon. Charles Rothschild.

I have, &c.,
A. ALCOCK,
Lieutenant-Colonel,
I. M. S. (retired list).

To the Secretary,
London School of Tropical Medicine.

Enclosure 3 in No. 1.

REPORT OF PROTOZOOLOGIST FOR THE HALF-YEAR ENDING 30TH APRIL, 1912.

In my last report I gave an account of certain experiments made in the summer of last year in Aleppo, Syria, with the object of testing the capabilities of the Sand Fly *Phlebotomus* to transmit the disease known as Oriental Sore. These experiments were explained in detail in that report, and it was pointed out that a sufficient time had not elapsed to enable one to judge of the results. However, after a further period of six months no sore has developed at the site of experiment, so that these attempts to transmit the sore by *Phlebotomus*, just as earlier attempts made in Bagdad with *Stegomyia fasciata*, have yielded only a negative result.

Thinking that such experiments would be rendered valueless if I proved to be immune to Oriental Sore, shortly before leaving Aleppo in September of last year, I inoculated by scarification on my arm material taken from a case of the disease. The immediate result of the inoculation was the production of a suppurating focus which eventually healed under a scab. A slightly pigmented patch was left in which two red spots could be detected. These eventually disappeared, and I thought there would be no further result. However, having returned to England, six and a half months after the inoculation I suffered during the course of a week from fever (100-103° F.), aching in the limbs, and a certain amount of gastro-intestinal disturbance. These symptoms, I thought, were due to influenza, and I was surprised to find that during this time there developed at the site of the original inoculation a tiny red papule, which increased in size during the course of the week. In this papule I eventually discovered the parasite of Oriental Sore. The papule has increased in size very slowly, and, in addition, two smaller papules have appeared near the first one, but still within the area covered by the inoculation focus. Several points of interest arise from this experiment

1. There is the long incubation period of six and half months.

2. At the appearance of the sore there was some disturbance of health, but was this an influenza which caused the sore to develop rapidly or was it caused by the sore itself? An experiment of Nicolle's is interesting in this connection. A man was inoculated with the virus of Oriental Sore. Nothing developed for seven

months, but during the course of an attack of Malta Fever a typical Oriental Sore appeared.

3. The rather extensive suppuration resulting from the inoculation was not sufficient to kill the parasites, though there was discharge of pus and much surrounding inflammation, which indicated the presence in the lesion of large numbers of phagocytes which might have been thought capable of destroying the leishmania before they had established themselves.

4. The appearance of the sore demonstrates that the fly-feeding experiments were not conducted on an immune person, so that it may safely be concluded that in these experiments leishmania were not injected by the fly bite.

5. In the production of Oriental Sore it is not necessary that a pure culture of the virus be inoculated. The presence of pyogenic organisms does not hinder a positive result. It comes about, then, that the ordinary discharge from a sore, consisting of a mixture of leishmania with pyogenic and saprophytic organisms, is capable of producing a sore if transferred to any wound or abrasion of the skin. It must frequently happen, in countries where the house flies are swarming over the sores and taking up myriads of parasites, that they deposit some of these on wounds not already infected.

Quite recently there was admitted into the wards of the Branch Hospital of the Seamen's Hospital Society at the Albert Dock a case of dermal leishmaniasis from Peru. This is apparently a case of the disease described by Escomel as espundia, and occurring in the forest regions of Peru and Bolivia, and in which Laveran and Nattan Larrier have discovered leishmania. In the present instance the case under the care of Sir Patrick Manson presented on the forehead a flattened sore raised about a quarter of an inch above the skin, with surface covered with granulations and crusts and discharging pus. There is a rounded red margin, with some surrounding injection of the skin. Another punched-out sore is situated at the outer canthus of the right eye. The lymphatic system draining these areas is involved to some extent.

I may record here that I have discovered leishmania in these lesions, and that I have been able to obtain a culture of this leishmania on the N.N.N. medium. An attempt has been made to treat the case along the lines recommended by Row by the injection of killed cultures. Laveran and Nattan Larrier, who examined smears from cases of espundia, described a peculiarity in the leishmania from this disease, which they stated to be of constant occurrence. Though many of the parasites show this peculiarity in the present case it is not constant, for many typical leishmania occur, and, further, the flattening of the nucleus against the fine capsule of the parasite, which is the point in question, occurs also in the case of leishmania from the Oriental Sore in the East. Experimental work with the Oriental Sore is still in progress.

During the past two Sessions I have been engaged in conducting the usual classes both in the General Course and in the Advanced Course.

In addition to the work outlined, I have been engaged in writing the "Kala-Azar Bulletins" for the Sleeping Sickness Bureau. Last year I was appointed a Sub-Editor on the Staff of this Bureau for this special work, and since then two numbers have been published, in which much of the literature dealing with the diseases due to leishmania has been reviewed. The two numbers referred to accompany this report.

I have also been engaged in editing the Protozoological section of the Journal of the London School of Tropical Medicine, to which I have contributed two papers and reviews.

1. Some recent Advances in our Knowledge of Leishmaniasis.
2. Note on the Occurrence of Herpetomonas in the Phlebotomus of Aleppo.
3. Reviews of papers dealing with the subject of *Theileria parva* and *Babesia mutans*, intestinal Amoebae of man and Anaplasmasis of Cattle.

C. M. Wenyon.

7th May, 1912.

No. 2.

LONDON SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 8 November, 1912.)

[*Answered by No.* .]

SIR, Royal Albert Dock, E., 8th November, 1912.

I HAVE the honour to enclose herewith the half-yearly reports of the Special Departments in Entomology, Helminthology, and Protozoology. Attached to Colonel Alcock's Report are the following pamphlets* :—

"Entomological Notes from the London School of Tropical Medicine, No. IV., Blood-sucking Diptera from Port Darwin," by Sophia L. M. Summers, M.A., B.Sc.

"A New Species of Phlebotomus from South America." By Sophia L. M. Summers, M.A., B.Sc.

"Epitome of the Species of Blood-sucking Muscidæ, Glossina excepted." By Sophia L. M. Summers, M.A., B.Sc.

Attached to Dr. Leiper's Report are the following* :—

"Some Nematode Worms from Lagos." By A. Connal, M.D., W.A.M.S.

"Bibliography of Dracontiasis." By Vera A. Inglis and R. T. Leiper, D.Sc.

Dr. Leiper, the Interim Wandsworth Scholar, left England on the 30th ultimo for the Cameroons, where he will endeavour to determine the mode of transmission of various blood worms of man, especially *Filaria loa*. On the outward journey he will land at Lagos to conduct an enquiry into the alleged occurrence of ankylostomes in the town wells.

During the academical year ending 31st July last there was a marked increase in the number of students attending the School—the total was 194. They may be classified as follows :—

Colonial Medical Service	90
Indian Medical Service	15
Foreign Office	1
Royal Army Medical Corps	1
United States Army	1
Australian Government	1
Indian Government	1
Foreign Governments	2
Missionaries	20
Private Students	62
	194

The above figures show that the resources of the School have been taxed to their uttermost. The new buildings which are in course of construction are expected to be complete at the end of the next Summer Session; there will then be accommodation in the large laboratory for nearly 100 students.

I am, &c.,
P. MICHELLI,
Secretary.

Enclosure 1 in No. 2.

REPORT OF THE ENTOMOLOGIST FOR THE HALF-YEAR ENDING 31ST OCTOBER, 1912.

In the summer session I gave the usual lectures and practical demonstrations in medical entomology, when the students examined and dissected the generic types of arthropoda concerned in spreading human disease, and familiarized themselves with

* Not reprinted.

most of the notorious species. I also conducted a special course for officers deputed by the Colonial Office; in this course, which was attended by nineteen officers, types of insect pests hurtful to man in other ways were also studied. I also gave the usual lectures—supplemented by demonstrations of most of the deadly species—on venomous snakes and snake-venoms.

Miss Sophia L. M. Summers, M.A., B.Sc., Carnegie scholar of the University of Aberdeen, continued to work in the laboratory under my direction, and published papers on blood-sucking diptera from Australia; on a new species of *Phlebotomus* from South America; and on the diagnosis and geographical distribution of all the known species of blood-sucking *Muscidæ*, Glossina excepted. Copies of these papers are annexed.*

Dr. A. T. Stanton, of the Kuala Lumpur Medical Research Institute, also worked in the laboratory in completion of his valuable studies on the life-history of the Malayan anophelines.

Among numerous miscellaneous experiments conducted in the laboratory one, worth recording, showed that *Cyclops* (the intermediary between the guinea-worm and man) is extremely sensitive to caustic potash, being killed instantaneously by a solution of 0·15 per cent., and mortally disabled by a solution half that strength.

The additions to the departmental museum have been numerous and valuable, and ample material is now in stock for the upkeep of the index and study collections.

Lieutenant-Colonel J. R. Adie, I.M.S., has presented a fine collection of Indian *Culicidæ*, including many species of *Anopheles*—malaria carriers and others.

Dr. A. Connal, of the West African Medical Service, has sent a large number of anophelines and other blood-sucking insects such as he knows by experience are most required for teaching purposes.

To Dr. R. E. Drake-Brockman we are much indebted for several consignments of the arthropod pests of Somaliland, including most useful series of *Stegomyia fasciata* in all stages of its existence.

Dr. A. T. Stanton, of the Federated Malay States service, has made a most valuable donation representing the known Malayan species of *Anopheles*, with the eggs and successive larval stages of many of them.

To Dr. C. L. Strangman we are under great obligation for a large collection of Australian blood-sucking diptera—a region hardly at all represented in our departmental museum, and also for several specimens of Australian venomous snakes.

Besides the above we have also received many named blood-sucking diptera from the African Entomological Research Committee.

Our acknowledgments are further due to the following gentlemen who have severally presented us with numerous desiderata :—

Dr. H. Bayon, Dr. H. S. Coghill, Major A. B. Fry, I.M.S.; Dr. A. Hutton, Dr. S. Johnson, Dr. Yale Massey, Professor G. H. F. Nuttall, F.R.S.; Dr. J. M. O'Brien, Dr. A. C. Parsons, Miss Gertrude Ricardo, Dr. R. Roper, Dr. P. Sharp, Dr. G. R. Twomey.

A. Alcock,
Lieutenant-Colonel, I.M.S. (retired).

London School of Tropical Medicine,
22nd October, 1912.

Enclosure 2 in No. 2.

Report of the Helminthologist for the Half-Year ending 31st October, 1912.

Sir,

I have the honour to submit my Report for the half-year ending November 1st, 1912, and to forward reprints of two publications* upon work of the Department which have been issued during the period.

My time has been devoted wholly to helminthological teaching and investigation, and, latterly, to preparations for a mission to Southern Nigeria, rendered possible by the allocation to the School Committee of the generous benefaction of the late Lord Wandsworth for medical research.

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* Not reprinted.

During the summer session the usual courses of (*a*) medical and (*b*) advanced helminthology, with practical work, were given, and the arrangement of the previous session was followed whereby both courses are given on the same days. The scheme was designed, apparently, to release the teacher for research work during all but three weeks of each term. In practice, it appears, in my experience, to greatly diminish the efficiency of the teaching, and in my own case has been followed on both occasions by an enforced period of absence from duty. The large classes of recent years have greatly increased the amount of time and energy which the provision of the large demonstrations and other practical methods of teaching involves. The overlapping of the ordinary and advanced courses has rendered the proper preparation of these demonstrations virtually a physical impossibility with the limited amount of skilled assistance available.

Early in the period under review Dr. Andrew Connal, of the West African Medical Staff, completed for publication a paper upon the various parasites found in the common animals around Lagos. A copy of the paper is appended to the Report, and I think it may safely be said that this is the first systematic contribution of a member of the Colonial Medical Staff to our knowledge of the helminthology of tropical Africa. It will be noted with satisfaction that Dr. Connal has secured a number of new species in a circumscribed area, which shows how profitable this particular field of study still remains.

In June, and again in September, Mr. R. C. Lewis, an 1851 exhibitioner, occupied a table in my laboratory, and gave special attention to the amphistomes of mammals. As my laboratory is closed during my absence he is continuing his work with Professor Stanley Gardiner at Cambridge. Other applications for laboratory facilities were received from individuals desirous of doing original work or of conducting investigations qualifying for higher degrees; but these had to be refused for the time being, as I felt unable to give more time to this side of the Department's work.

In August I proceeded again to Germany to continue my study of types. While in Berlin I examined, for the Natural History Museum, a collection of helminths from German East Africa. The extension of my tour to Paris had to be postponed, as I understood that the laboratory was closed and the types of Railliet would not be available until October.

In London my investigations have comprised :—

(1) A systematic examination of material received from various sources, *e.g.*, from the Zoological Gardens (monthly); from the British Museum (through the courtesy of Professor Jeffrey Bell); from the Indian Museum, Calcutta; and from a number of collectors abroad. It has not been possible to do more than arrive at a rapid preliminary diagnosis in many cases, owing to the nature and variety of the material passing through my hands.

(2) Material which has been examined and provisionally diagnosed is arranged in groups, and these groups are made the basis of a more detailed study. During the past six months I have, with the assistance of the bibliographical assistant, been able to review fairly fully the literature and the material of the family oxyuridæ, and similarly have made some investigations into certain groups of the Bursate nematodes. Unless further results annul the results already arrived at, it would appear that some radical change will be necessitated in our views of the systematic arrangement of this latter group.

(3) Some time has been devoted to work of an experimental character :—

(*a*) I have endeavoured to ascertain the value of various recognised methods of sterilising drinking water in the prophylaxis of guinea-worm disease. The ideal to be striven for, in my opinion, is a drug or method which would sterilise the water in the bacteriological sense, would be efficient as a "cyclopicide," would give no precipitate in waters such as those commonly regarded by natives as potable, and be harmless when taken in quantity over a prolonged period. The only drug which hitherto has appeared to satisfy these conditions is chinosol, which, however, is of a price prohibitive of general use on a large scale.

(*b*) With the official assistance of the Veterinary Laboratory of the Board of Agriculture a series of attempts have been made to determine the mode of infection and of spread of the lung parasites of sheep.

The experiments have apparently demonstrated that these nematode worms, although similar structurally in some respects to other bursate nematodes, follow an entirely different course of development. The embryos in passing from the bronchiole up the trachea reach a certain stage of development. They then remain quiescent, and are passed out in the fæces, having traversed the whole alimentary canal without change. Outside the body no further developmental change could be induced, and it appears evident from this fact and from the structure of the embryo that an intermediate host is necessary: probably one which breeds in the droppings of herbivorous animals. As the enquiry proved of considerable helminthological interest as well as of distinct economic importance it is proposed to pursue it further in the coming summer if facilities are again obtainable.

4. (*a*) By kind intervention of Major Clayton Lane I had an opportunity recently of examining the type specimens of *Strongylus colubriformis*, a parasite of sheep in Assam. These prove to be the same as a rare parasite of man, *Trichostrongylus instabilis*. Undoubtedly infection of man is derived from the sheep. According to the law of priority the name of the parasite must now be *Trichostrongylus colubriformis*.

(*b*) Dr. Massey has sent specimens from painful subcutaneous tumours found in the Congo and resembling closely Calabar swellings. These proved to be due to *Onchocerca volvolus*. Apparently the cases were at an earlier stage in the infection than has been hitherto noted.

(*c*) From Nyasaland Dr. Stannus forwarded some material from seven cases treated for ankylostomes. The worms passed in two of these cases have proved on minute examination to be *Triodontophorus deminutus*, a form which has hitherto been recorded only by Railliet and myself. Dr. Stannus and Dr. Turner have now sent material from several Nyasa natives, and it would, therefore, appear to be a very common parasite. The ova closely resemble those of ankylostomes and the diagnosis can only be made from a careful scrutiny of the mouth capsule. The worm lives wholly in the great intestine, and most probably gives rise to blood changes similar to those of ankylostomiasis.

(*d*) Mr. Lloyd, of the Sleeping Sickness Commission in Rhodesia, sent a number of nematode parasites found in *Glossina morsitans*. These have proved to belong to a species of *mermis*, and to be allied to a form found in *Glossina palpalis* by Professor Minchin and described by me about two years ago.

(*e*) Dr. King, of St. Lucia, submitted a fragment of a nematode worm coughed up by an Irish nun who had resided for fourteen years in St. Lucia, and had up to that time suffered from a chronic cough. A note of this case is being published.

(5) A considerable amount of bibliographical work has been undertaken, mainly by Miss Inglis (the bibliographical assistant in the Department) under a special grant from the Colonial Office. The School Committee have permitted me to undertake the section of helminthes in the new Tropical Diseases Bureau's Bulletin, and the literature for the first quarter has been annotated. Miss Inglis has endeavoured to compile complete bibliographies of the literature of some of the helminthic affections up to the date of the commencement of the new Bulletin. That dealing with dracontiasis has been passed for press and a proof accompanies the present report. A bibliography of Bilharziosis is nearly complete, and should be in the printer's hands very shortly, although its issue may be delayed owing to my absence in West Africa. Miss Inglis has assisted in the secretarial work of the Department, and I am in hope that if the Committee see fit to continue the grant for the work in which she has now become useful her services may be retained.

I have, &c.,
ROBERT T. LEIPER.

Enclosure 3 in No. 2.

Report of the Protozoologist for the Half-Year ending 31st October, 1912.

Teaching Work.

During the first part of this period, before the summer vacation, I conducted as usual the protozoological section of the general course and also the advanced course in protozoology. Seven students attended the latter course of instruction, which includes practical study of various methods of staining and preparation of protozoa which are too involved for the general course. The following list of subjects indicates the character of the advanced course.

1. Staining of the protozoa by the various modifications of the Romanowsky stain.
2. The wet fixation of the protozoa and its importance from the point of view of the true structure of these organisms.
3. The methods of staining the entamœbæ and other intestinal protozoa.
4. The cultivation of amœbæ.
5. The cultivation of trypanosomes and leishmania on blood agar media.
6. The dissection of insects from the point of view of determining a protozoal infection, and the methods of preparation of these.

Research Work.

A great part of my time during the past six months has been occupied in the several lines of investigation indicated under their respective headings below. This has included :—

1. An investigation into the pathogenicity of *Entamœba tetragena*, the pathogenic amœba of man, with experiments on the production of dysentery and liver abscess in cats.
2. An enquiry into the behaviour of *Leishmania tropica* in bed bugs and fleas, with a view to determining if these insects can act as true hosts and transmitters of the parasites of Kala-azar and Oriental Sore.
3. Observations on the natural flagellates of fleas, including a confirmation of Nöller's important results on the transmission of *Trypanosoma lewisi* by the dog flea.
4. Experiments with the virus of the South American leishmaniasis, including the culture of the organism and the production of the disease in the monkey and dog.
5. Observations on the morphology of *Trypanosoma rhodesiense*, and the behaviour of this trypanosome in the bed bug.
6. Experiments on the transmission of canine piroplasmosis by ticks collected in Aleppo in August, 1911.

I. *Dysentery and Liver Abscess due to Amœbæ.*

The subject of amœbic dysentery is one which has occupied my attention for some time, but recently I have been able to carry out a series of experiments with material obtained from cases of dysentery which show in striking manner the pathogenicity of the amœba so frequently associated with dysentery in man. Not only have I been able to reproduce dysentery in animals by injection of the amœba from man, but by sub-inoculations I have succeeded in carrying on the infection in cats for four passages, and it was only through an accident that there were no further sub-inoculations. My experiments show that the cat is very susceptible to injection of the human pathogenic amœba, and that it would be possible by sub-inoculating to maintain a strain of amœbæ indefinitely. That cats would contract dysentery when they were injected per rectum with material from cases of amœbic dysentery in man was first shown by Kartulis, and has since been repeated by many observers. More recently Hartmann, Viereck, and Werner have attempted to carry on the infection from cat to cat by sub-inoculation, but they have found that the strain usually dies out after two, or at most three, passages. In my experiments I have carried the amœba through a greater number of passages than has hitherto been done.

Further, one other most interesting result of my experiments has been the appearance, in one of the dysenteric cats, of four abscesses in the liver, in which amœbæ were present in considerable numbers. It is known that liver abscess may and does

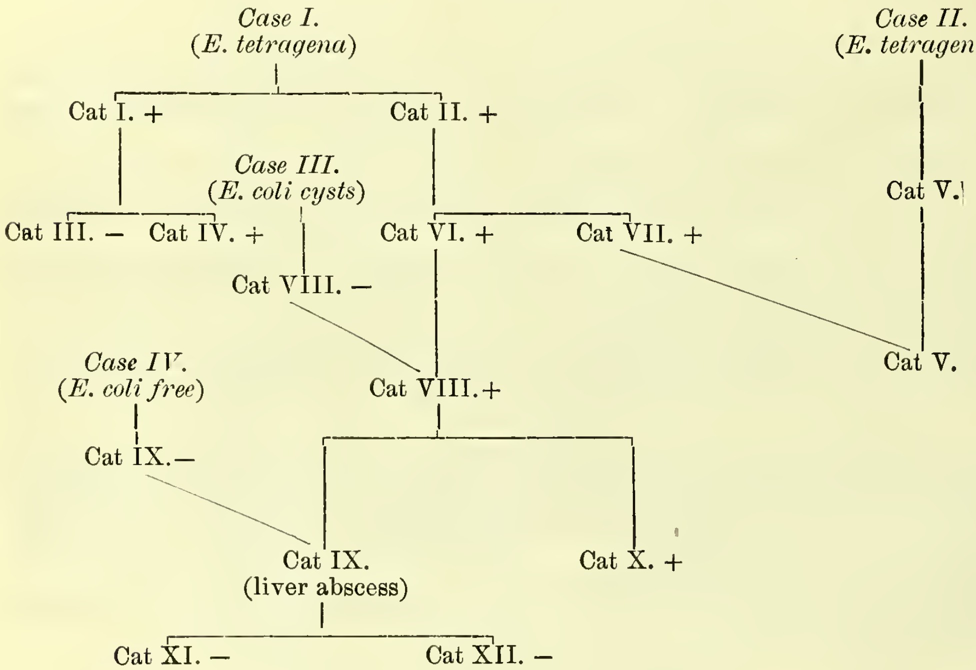
occur as a complication of amœbic dysentery in man, so that I have been able to reproduce in the cat the whole picture of amœbic dysentery in man together with its final complication of amœbic abscess of the liver.

In only one instance have I found a cat refractory to rectal injection of dysenteric amœbæ. This was a large cat which remained uninfected when injected directly from a case of dysentery, and again later, when injected from an already infected cat.

The strain of amœbæ used in these experiments is the one now usually known as *Entamœba tetragena*, and which is probably identical with Schaudinn's *E. histolytica*. It was recognised by the presence of large numbers of the encysted forms, which are quite characteristic and can be identified much more readily than the amœbæ themselves. The infection was produced by injecting infected material into the large intestine per rectum.

Attempts were also made to infect two cats with the harmless *Entamœba coli*, but without success. One cat received a large quantity of free and encysted *Entamœba coli* both per rectum and per œsophagus, while the other cat received free *E. coli* per rectum. Both these cats were subsequently infected with the pathogenic amœba. It appears from these experiments quite clear that there is a definite pathogenic, as distinguished from a non-pathogenic, amœba of man.

The following tree indicates in a clear manner the various experiments :—



The amœbæ were obtained from four cases, two of which harboured Entamœbæ of the pathogenic type recognised by the cysts with four nuclei and two *Entamœba coli*, one with free and encysted *E. coli*, and the other with only free forms. In the sub-inoculations the large intestine of the infected cat was washed in normal saline which was then injected into the next cat. The + or — sign indicates the positive or negative result obtained. One dozen cats were used in the experiments, and it was only due to the fact that cat IX. died unexpectedly one night that it was not possible to carry on the infection further. It was cat IX. which developed the four amœbic abscesses of the liver. Cat III. was injected only per œsophagus with free amœbæ, and did not become infected.

In every case where there was a positive result the amœbæ which appeared in the intestine and in the tissues about the dysenteric ulcers of the cats had the same structure as those which occurred in the case of dysentery in the first instance. Another feature of the infection was the frequent occurrence of amœbæ in the mesenteric glands draining the ulcerated areas of the large intestine. When they gain entrance to the intestine the amœbæ make their way into the tubular glands, and ultimately produce a disintegration of the glandular epithelium, especially at the blind ends of these. The amœbæ then pass into the tissue beneath, and produce the destruction which leads to the characteristic undermined ulcers of amœbic dysentery. Exactly which is the path by which the amœbæ make their way from the intestine to the liver is not quite clear. The path of the portal vessels is the most

probable, but the occurrence of amœbæ in the mesenteric glands suggests the possibility of a lymphatic course.

The results of these experiments are embodied in a paper to appear in the forthcoming number of the Journal of the London School of Tropical Medicine.

II. *The behaviour of* Leishmania tropica *in Bed Bugs and Fleas.*

A. *Experiments with Bugs.*

I first showed that *Leishmania tropica,* the cause of Oriental sore, would develop into flagellate forms in the bed bug, just as Patton had previously demonstrated for the parasite of Indian Kala-azar. The development obtained by Patton convinced him that the bed bug was the true host and transmitter of Kala-azar. I did not hold this view, but concluded, as Mesnil has suggested, that the leishmania developed in the bug's intestine as in a culture tube containing blood media, and that the development undergone by the leishmania was in itself no proof that the bug was the true host.

I have recently tried to obtain further light on the behaviour of the leishmania in the bed bug, and have fed numbers of these insects on a case of Oriental Sore, and after keeping them in the cool incubation (22°-23° C.) for varying times studied the development undergone by any leishmania they may have taken up. In all one hundred and five bed bugs were fed upon the sore. Most of the bugs had been hatched from the egg in the laboratory. It was found on dissection that flagellates developed from the leishmania were found in only three of these, and then in small numbers. The dissections of the bugs were made from one to eight days after feeding, and the three found infected with flagellates were dissected on the second or third day. It was thus apparent that no very active multiplication had taken place, and that unless the bug could take up large numbers of parasites no large infection of its gut with flagellates would occur. In Patton's recent experiments with Kala-azar he had obtained a large infection of the gut, but in this case the bugs had fed upon a case where in the peripheral blood there were comparatively large numbers of parasites. In the case of Oriental Sore it is not possible for the bug to take up such numbers of leishmania. The development in the bug then appears to depend upon the quantity of blood taken up, and development and multiplication of the leishmania proceeds only so long as the blood remains incompletely digested. Towards the end of digestion the development ceases and the elongate flagellates become replaced by small, round flagellate forms which Patton describes as post flagellates. These are the forms which Patton supposes are re-injected into man when the infected bug bites. From a study of the cultural forms of the leishmania I find that as the nutriment in the medium is becoming exhausted similar round flagellate forms replace the elongate flagellates, so the appearance in the bug of Patton's post flagellates is only a further instance of the similarity of development of the leishmania in the test-tube and in the intestine of the bug.

I have already shown that the spirochœte of relapsing fever may remain alive and active in the bug's gut for as long as a week, and Swellengrebel and Strickland have shown that the *Trypanosoma lewisi* of the rat will survive in the bug for nine days. I have repeated the observations on *Trypanosoma lewisi* and can confirm them. Further, I find that the human trypanosome *T. rhodesiense* will survive in the bug for over a week, and Brumpt had demonstrated that the South American trypanosome of man will develop in the bug for a longer period, and is ineffective for rats up to ten days after being taken up by the bug. From these observations made by me and others it is apparent that the intestine of the bug when filled with blood presents a medium peculiarly suited to the development and persistence of flagellates. This persistence in the bug's intestine appears to vary in proportion to the ease with which the particular flagellate is culturable in a blood agar medium. Is it to be wondered at, then, that the readily cultured leishmania, whether of Kala-azar or Oriental Sore, undergoes a similar development? It would be surprising if it did not so develop. It thus appears that from the experiments on the behaviour of these various flagellates in the bug we have no evidence that the bug is the true host of any of these, and cannot condemn the bed bug as the bearer of Kala-azar or Oriental Sore on these grounds alone. It is quite possible that the bug is the transmitter of Kala-azar in India. There is nothing against this view, but at present the matter must rest *sub judice* till the conclusive experiment of transmission has been carried out.

B. *Experiments with Fleas.*

It was claimed by Basile that he had transmitted Kala-azar (Mediterranean variety) to dogs by means of fleas, and that in these insects he had discovered the developmental forms of the leishmania. I thought it would be of interest to investigate the behaviour of the *Leishmania tropica* in fleas as a means of confirming Basile's results. Experimentation with these elusive creatures was very difficult till Nöller demonstrated the possibility of securing them on very fine wire for experimental purposes after the manner of those who exhibit performing fleas for a livelihood. I adopted this method, and found it highly satisfactory. Fleas, both dog and human (*Cteinocephalus canis* and *Pulex irritans*), were fed upon the case of Oriental Sore. I discovered first of all that the fleas so feeding would take up leishmania from the sore, and that these could be recovered in the fæces of the flea, which are passed during the act of feeding. It was possible to exclude the occurrence of a natural flagellate infection of the flea by examination of the fæces of the flea prior to experiment while it was feeding on a healthy person. While feeding, the flea's intestine is literally washed out with blood so that, after feeding for about half an hour, the fæces (which are passed every few minutes) consist of pure blood, and it is easy in films of this to determine if any natural flagellate infection exists.

It was found that, though the leishmania were taken up by the fleas when they fed upon the Oriental Sore, no development into flagellates took place, and that no trace of the leishmania were to be found after twenty-four hours. They had disappeared. Many fleas were experimented with, and about one hundred feeds upon the sore were made without there being obtained the slightest evidence in favour of any development within the flea. It seems, then, that the *Leishmania tropica* will not produce a flagellate infection of the intestine of either the dog or human flea. Basile claimed that such an infection could be obtained in the case of the very similar parasite of Mediterranean Kala-azar. It must be admitted that the two parasites are not exactly alike, but they are so similar that at least some indication of development should have been obtained. There is, however, a possible explanation of Basile's results. I have found, as Nöller has done, that the fleas may harbour a natural herpetomonas which, in many of its stages, is indistinguishable from developmental forms of the leishmania of Kala-azar and Oriental Sore. Further, the percentage of fleas naturally infected with this flagellate is often greater than the percentage of fleas Basile supposed to be infected with the leishmania; hence it is highly probable that the flagellates observed by Basile in the flea were in reality the flea herpetomonas, and not the leishmania he supposed them to be. Basile had taken no precautions to exclude a natural herpetomonas in his fleas so that, until further evidence is forthcoming, we must conclude that the flagellates seen by him, and also by Sangiorgi and Alvarez and Pereira da Silva were none other than the natural flagellates of the flea. It is to be hoped that some further experiments with fleas and the Mediterranean Kala-azar will be made, and that every precaution [will] be taken to exclude the possibility of a natural flea infection. The question is a most important one, for, if it be found that no such development as Basile describes takes place in the flea, then it must be very doubtful if the flea is the real transmitter of that form of Kala-azar which occurs in so many endemic centres along the Mediterranean littoral.

III. *Some Observations on the Natural Flagellates of Fleas.*

A. *Herpetomonas of the Human and Dog Fleas.*

I have found, as Nöller has already reported, that the flea (*Pulex irritans*) may be naturally infected with a herpetomonas. The presence of such an infection may be readily ascertained by the simple procedure of the examination of the fæces of the fleas passed while they are feeding on a healthy rat or person. The fæces in such cases contain large numbers of all stages of the parasite from the elongated flagellate forms to the rounded, probably encysted, bodies which are undoubtedly responsible for the transmission of the infection to the flea larvæ. By keeping such infected fleas and feeding them every three or four days I have found that the herpetomonas infection is a permanent one, and that the human blood has no harmful effect on the flagellates. On the contrary, the flagellates which remain behind in the gut after the flea has fed have so multiplied by the time of the next feed that they are passed in equally great numbers in the fæces. Such a flea I have had under observation for over two months, and at every feed enormous numbers of flagellates are passed.

A dog flea (*Ctenocephalus canis*) was also found to be infected with herpetomonas.

Having determined that a rich culture of flea herpetomonas could be obtained on N.N.N. medium from the fæces of the flea, I thought it would be of interest to test the resistance of the small encysted forms of the herpetomonas which were found in such numbers in the fæces. Accordingly a series of experiments were made in the following manner. The fæces of the flea passed during the feeding act was received on to a sterile cover glass. It was made into a film with a sterile needle, and the cover glass was then placed in a sterile Petri dish. The fæces dried almost instantaneously. After the lapse of varying intervals of time the sterile cover glass was dropped into the water of condensation in a tube of N.N.N. medium. Five experiments were made up to an interval of twenty-four hours. In one case there was a contamination with bacteria, but in the four others (including the film which had dried for twenty-four hours) a rich culture of the flea herpetomonas was obtained. It may thus be concluded that the cystic forms of herpetomonas voided by the flea in its fæces are very resistant structures which can withstand drying for a period of twenty-four hours, and probably longer.

B. Trypanosoma lewisi *in the Dog and Human Flea.*

Having at my disposal both dog and human fleas which had refused to become infected with leishmania I thought it would be of interest to test the possibility of their becoming infected with *Trypanosoma lewisi.* Some of them were accordingly fed upon an infected rat. I was able to confirm the observation of Nöller that a complete development would take place in the dog flea, and that in about six days after feeding the typical small infective trypanosomes of Swellengrebel and Strickland appeared in the flea fæces. As a further confirmation of Nöller's results, the following experiment was undertaken. A dog flea which contained the infective trypanosomes in its fæces six days after feeding on rat A infected with *T. lewisi* was allowed to feed upon a clean rat B. While it was feeding on rat B it was carefully watched, and all fæces passed were collected on a cover glass and taken up in culture fluid with a fine glass pipette. The contents of the pipette were then discharged into the mouth of a clean rat C, great care being taken that the mouth of this rat was not injured in any way. The result was most interesting. Rat B did not become infected, but rat C had trypanosomes in its blood on the sixth day. Thus, I have been able to confirm the result of Nöller, who stated that it is not the act of biting which infects the rat, but that infection is brought about by the rat licking up the fæces passed by the flea while feeding.

The human flea, *Pulex irritans*, is also able to serve as a true host for *T. lewisi*, for I have been able to transmit the trypanosome by its means in exactly the same manner. The small infective trypanosomes appear in the fæces and are just as persistent as they are in the dog-flea. The incubation period in the rat fed with the fæces of *P. irritans* was seven days. The rat upon which the flea fed has not become infected.

Another observation of much interest is this. The fleas, when once infected with *Trypanosoma lewisi*, remain infected for long periods, for though many small infective trypanosomes are washed out of the gut at each feed those that remain behind multiply to re-establish the infection of the hind gut. Further, the infection is still maintained even if the flea is nourished on a human being, so that fresh human blood does not appear to be destructive to the infective forms in the flea.

IV. *Experiments with the Virus of South American Leishmaniasis.*

In my last half-yearly report I noted that I had had under observation a case of dermal leishmaniasis from South America in an Englishman who had contracted the disease when travelling in Peru and Bolivia. I also reported that I had obtained a culture in N.N.N. medium of the leishmania which is the cause of this disease. I have now extended my observations on this form of leishmaniasis.

A. *Treatment of the Case.*

Much interest attaches to the treatment of the case. Dr. Row, in India, had reported having obtained good results in the treatment of Oriental Sore by the injection of killed cultures of *Leishmania tropica.* Accordingly I made an attempt to

treat the present case in this manner. Doses of killed cultures of the leishmania obtained from the lesions were injected hypodermically according to the directions of Dr. Row. The injections produced no bad results, but neither did they appear to produce any good one, so that such a line of treatment was of no avail in checking the malady. The patient was treated then with an ointment consisting of equal parts of methylene blue, lanoline, and vaseline, as recommended by Cardamatis and Melissidis, who have found it efficacious in Oriental Sore. The two Sores, one a small one and the other a large one, were treated with applications of the ointment morning and evening. The small one rapidly healed in about three weeks. The large sore was treated for about two months in this way, after which the methylene blue ointment was stopped, and a simple vaseline applied. The sore was completely healed in another fortnight. It appears that this ointment was efficacious in destroying the leishmania, for on two occasions during the treatment I attempted to obtain a culture of the organisms as was done before treatment was commenced, but without result. It is to be hoped that this treatment will receive a thorough trial, for it may prove to be a valuable remedy in the treatment of this distressing malady.

B. *Experiments with Animals.*

With virus obtained from the sore a dog and a monkey (Cynocephalus) were inoculated in the nose and ears. After an incubation period of three months the dog had developed a sore on each ear, and in these the typical leishmania were discovered. One month later, with an incubation of four months, the monkey had developed similar lesions on the ears. These were also due to leishmania. With material from one of the sores on the monkey's ear a dog was inoculated in the ears, and in twenty-three days it had developed typical sores at the points of inoculation. Similarly a third dog was inoculated from the first dog, on the ears. It also became infected in thirty days.

The dermal leishmaniasis of South America can thus be reproduced in dogs and monkeys. It is my intention, when some of these animals have recovered from the infection, to test their immunity reaction against other strains of leishmania, especially that of the eastern sore, with a view to deciding whether the eastern and western diseases are distinct or not.

C. *Cultivation of the Organism causing South American Leishmaniasis.*

1. As I have already reported, I have obtained a culture of the leishmania in N.N.N. medium. The organism grows very readily on this, so that now I have maintained it for upwards of seven months, and carried it through sixteen generations. The cultures showed no signs of dying out, so that it may safely be concluded that they may be maintained indefinitely. The character of the culture is very similar to that of other forms of leishmania, and I am unable to give any features by which the cultures of the South American leishmania could be distinguished. There is a great uniformity in the cultural forms of the leishmania from whatever source they are obtained, and I have been able to compare the cultures of the leishmania of infantile Kala-azar and Oriental Sore of Aleppo with those obtained from the case from South America.

2. The best culture medium for the various forms of leishmania, and also for the herpetomonas of the flea and the crithidia from *Melophagus ovinus*, which I have also cultivated, has been the well-known N.N.N. medium. Dr. Row has described a simpler liquid medium which he says is very suitable for the culture of these organisms. I have tried his medium, but without much success. I have also used another medium which is really a modification of Row's medium. It is prepared as follows :—Five cubic centimetres of blood are withdrawn aseptically from the vein of a rabbit's ear. It is transferred to a small flask containing beads, and is defibrinated by gentle shaking. To this flask is then added 45 cubic centimetres of sterile distilled water. This lakes the blood and gives a solution of hæmoglobin. There is then added ·425 grams of sterile sodium chloride. The liquid medium is now ready and is transferred by means of a sterile pipette in quantities of about two cubic centimetres to sterile test-tubes. In this medium, which is very easily prepared, I have been able to maintain for several generations the leishmania of infantile Kala-azar, the leishmania from Aleppo sore, the leishmania of South American sore, and the herpetomonas of the flea. Though it would be possible to maintain culture of the organisms indefinitely in this medium, the growth is never very abundant, and one does not have the luxuriant culture characteristic of the

N.N.N. medium. I have found that the leishmania of infantile Kala-azar, now at the seventh sub-culture in this medium, grows best, while that of the Aleppo sore [grows] with greatest difficulty. I hope by further modification to obtain a more satisfactory liquid medium for the growth of these organisms.

3. An attempt was made to infect a young rabbit by intravenous injection of a rich culture of the South American leishmania, but no infection was produced.

V. *Trypanosoma rhodesiense.*

A. *Morphology.*

In connection with the morphology of the species of human trypanosome now known as *T. rhodesiense* I made the interesting observation that the nuclean arrangement which was the cause of the creation of the new species of human trypanosome was not peculiar to this trypanosome. I found that exactly the same arrangement of the nuclei also occurred in *Trypanosoma pecaudi* of the Soudan, a trypanosome which is there pathogenic for domestic animals. A further point of interest was that the percentage of trypanosomes showing this peculiarity was approximately the same in the *Trypanosoma pecaudi* as in the original description of *T. rhodesiense* by Stephens and Fantham, the creators of the new species. It results that the internal morphology alone cannot be relied upon as a means of distinguishing this trypanosome from others.

B. *Culture.*

Attempts have been made to obtain a culture of *T. rhodesiense* in the N.N.N. medium, and also in the liquid medium described above. The results were as unsatisfactory as those previously obtained by other observers. Though the trypanosome would multiply and change into crithidial forms in this medium and remain active for as long as fifteen days no satisfactory sub-culture was obtained.

C. *Behaviour in the Bed Bug.*

The persistence and development of *T. rhodesiense* in the bed bug has been the subject of an enquiry. I have found that this trypanosome will persist in the bug for over seven days, and that during this time there are produced crithidial and herpetomonas forms and, eventually, small rounded bodies closely resembling leishmania.

VI. *Piroplasmosis of Dogs.*

A number of ticks (*Rhipecephalus sanguinosis*) were collected from an infected dog in Aleppo, Syria, in September last year. These were brought home to England for experimental purposes. The dog from which they were taken was not only infected with the piroplasm, but also with the leucocytic hæmogregarine. In March, 1912, six months after removal from the infected dog, the ticks were placed on a young dog, and the majority soon became attacked. Three months later this dog showed a small infection with typical *Babesia canis*. The infection was only a temporary one, for three days later the parasites had disappeared. About ten drops of blood from this dog were then injected into another dog, which, however, did not become infected, so that the strain of piroplasm was lost. The dog which contracted the transient piroplasm infection has shown no sign of infection with the hæmogregarine. This dog was subsequently inoculated with the leishmania of South American sore with a positive result.

Literary work.—In connection with the Sleeping Sickness Bureau, as a sub-editor for the Kala Azar Bulletin, I have completed the third number of the publication. This number, with the two previously published, contains a review of most of the past literature on the subjects of Kala-azar and Oriental Sore. It is hoped that the three numbers will be of service to those who are interested in the question of the various leishmaniases, and who cannot have access to much of the literature, which is often inaccessible. Now that the Sleeping Sickness Bureau has extended its sphere of action and has expanded into the Tropical Diseases Bureau I shall continue the review of the literature of leishmaniasis in the Tropical Diseases Bulletin. In addition I shall deal with the subject of yellow fever.

During the period covered by this report the following papers have been published by me dealing with investigations undertaken in my Department :—

(1) A case of dermal leishmaniasis from South America with some Remarks on the Structure of the Parasite and its Culture.
(2) Some Critical Remarks on Captain Patton's Report on Oriental Sore.
(3) Some Remarks on the Successful Inoculation of *Leishmania tropica* to Man.
(4) The Insufficiency of the Posterior Nucleus as a Specific Distinction in *Trypanosoma rhodesiense.*
(5) A Supposed Peculiarity in the Structure of the Leishmania from Skin Lesions in South America.
(6) Kala Azar Bulletin, No. 3.

C. M. Wenyon.

APPENDIX V.

Reports from the Liverpool School of Tropical Medicine.

No. 1.

LIVERPOOL SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 7 May, 1912.)

SIR, B 10, Exchange Buildings, Liverpool, 6th May, 1912.

I HAVE the honour to enclose, for the information of the Tropical Diseases Advisory Committee, the following reports of the Liverpool School of Tropical Medicine for the six months ending 30th April, on the work done in connection with the Government Grant, viz. :—

(1) Report of the Walter Myers Lecturer of the School (Dr. J. W. W. Stephens).
(2) Report of the Acting Director of the Runcorn Research Laboratories of the School (Dr. B. Blacklock).
(3) Report of the Professor in Entomology (Mr. Robert Newstead).
(4) Report of Dr. G. C. E. Simpson, on chemical researches in connection with the special grant made by the Advisory Committee for the Tropical Diseases Research Fund for this work.

I am, &c.,
A. H. MILNE,
Secretary.

Enclosure 1 in No. 1.

SIR, 2nd May, 1912.

I BEG to submit the following report on the work done during the period from November 1st, 1911, to the 30th April, 1912.

Students.—The number of medical men who attended the Autumn Term was 13, and the number for the Lent Term 19; total, 32. This number includes members of the Royal Army Medical Corps, Indian Medical Service, West African Medical Staff, Colonial Medical Service, &c.

Diploma of Tropical Medicine.—The number of candidates who entered for the examination in December was 10, of whom 9 passed. The number of candidates for the April examination was 18, of whom 17 passed.

Museum.—The thanks of the School are due to the following gentlemen for their kindness in sending specimens to the School during the last six months :—

Dr. C. J. Murphy, Sierra Leone; Captain P. K. Tarapore, India; Dr. N. Leon, Iasi; R. E. Montgomery, M.R.C.V.S., Nairobi; Dr. Bell, Hong Kong; Dr. W. J. Bruce, Mopea, Portuguese East Africa; Dr. R. H. Kennan, Freetown, Sierra Leone; Dr. M. Ricona, Cape Colony; Professor R. Newstead, Expedition to Nyasaland; Dr. Hanna, Liverpool; Professor Dr. M. Miyajima, Tokio; Dr. Borle, N. Transvaal; Dr. L. F. Jaggard, Congo Free State.

Research Work.

Trypanosoma rhodesiense (Stephens and Fantham).

The results of the measurements of this trypanosome by Dr. Fantham and myself were read before the Royal Society on the 2nd May, and will be published shortly in a paper in their proceedings. The paper was illustrated by a plate kindly prepared for us by Lady Bruce, to whom our sincere thanks are due. We obtained, as a result of our measurements, two curves, viz., one of 1,000 trypanosomes

(comprising 400 from various animals, and 600 from rats); and secondly, a curve from the 600 trypanosomes from rats alone. We compared these curves with those obtained by Sir David Bruce for *Trypanosoma gambiense* and *T. brucei*, and found that the curve of *T. rhodesiense* closely resembled that of *T. brucei*, but not so closely that of *T. gambiense*. On analysing the figures on which these curves were based we have come to the following conclusions :—

(1) That a sample of 20 is too small to give an accurate result, but our data do not enable us to state definitely how large a sample must be taken in order to give more accurate figures.

(2) That the day on which the sample of trypanosomes is taken is a most important factor. For instance, if a sample be taken on one day we may find only 10 per cent. of so-called stumpy forms (13-21 μ), whereas if a sample is taken from the same animal on another day there may be 95 per cent. of stumpy forms.

(3) That probably the host from which the sample of trypanosomes is taken is also an important factor, but it is impossible at present to state this with certainty, owing to the fact that different measurements arising from different hosts may be due to the influence of the different day of infection. We therefore suggest that it would be advisable in measuring trypanosomes to measure them from one animal only, *e.g.*, a tame rat, as being the most convenient animal, and in order to obviate the influence of the particular day it will be necessary to measure the trypanosomes on every day of the infection.

Accordingly, during the early part of this year, we have measured yet another 1,000 trypanosomes of *T. rhodesiense* from a single rat, from the first day on which the rat showed trypanosomes until the death of the animal, measuring 100 trypanosomes per day. As far as our analysis of these figures has gone we can make the following statements :—

(1) We confirm our previous statement that the day of infection is of great importance, as again we find that there is a great variation in the percentage of stumpy forms on different days, from *e.g.*, 53 per cent. on the 7th day to 5 per cent. on the 10th day.

(2) As regards samples of 20, there may be on the same day a range of 5·4 μ in the average length. If, on the other hand, we take samples of 50 on the same day, the range of the average length is reduced to 3·3 μ. We may, therefore, presume that if we took samples of 100, at the same time on the same day, the variation in the average length would be still further reduced.

As far, therefore, as our present analysis of the figures goes a sample of 100 trypanosomes on a particular day, as used in this research, gives us a much more accurate result.

In general terms, we may say that this last curve obtained of 1,000 trypanosomes from a single rat resembles closely our previous curve obtained from 600 trypanosomes from rats, as both have a maximum peak at 26 μ, and not so closely the curve obtained from a thousand trypanosomes from various animals. We believe, therefore, that in order to obtain an accurate curve for a dimorphic trypanosome, such as *T. rhodesiense*, it will be necessary to measure 100 trypanosomes from a single animal (a rat) on each day of the infection.

Paropisthorchis caninus, Syn. *Opisthorchis noverca*.

I have completed my examination of this fluke, and the description will appear in the Annals of Tropical Medicine, Vol. VI., No. 2, May, 1912.

I have come to the conclusion that the flukes described by Lewis and Cunningham and McConnell respectively are different species. Independently of me, Professor F. D. Barker, of Nebraska University, has arrived at the same conclusion, and has proposed for Lewis's fluke from the dog in India the name *Opisthorchis caninus*. From a study of the anatomy of this fluke, which possesses an elongated process anteriorly bearing the sucker and genital pore, I have come to the conclusion that it should be put in a separate genus, for which I propose the name *Paropisthorchis*. Hence the name of this fluke would be *Paropisthorchis caninus*. McConnell's fluke

found in man Professor Barker has placed in a new genus *Amphimerus*. Hence the name of this fluke would be *Amphimerus noverca*.

I am, &c.,
J. W. W. Stephens, M.D., Cantab.,
Walter Myers Lecturer in Tropical Medicine.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
Liverpool.

Enclosure 2 in No. 1.

Sir, Runcorn Research Laboratories, Runcorn, April 30th, 1912.

I have the honour to submit to you this report on the work done in the Runcorn Research Laboratories of the Liverpool School of Tropical Medicine during the period from November 1st, 1911, to April 30th, 1912.

The grant has been expended on the upkeep of the laboratories, on the purchase and maintenance of the animals required for the purposes of preserving the various strains of trypanosomes and other protozoa, and on carrying out research.

Dr. Warrington Yorke's paper on the subject of the passage of hæmoglobin through the kidneys has now been published.

At the conclusion of my previous report, I referred to the horse which Professor Todd had sent from the Gambia suffering from trypanosomiasis. It was of some importance, in view of the fact that this horse showed two types of parasite in its blood, a long free flagellated form and a short non-flagellated form, to endeavour to decide exactly the relationship of these parasites to each other. The first parasite, the long form, was mentioned in the report referred to as probably being *Trypanosoma vivax*, on the grounds of morphology and animal reactions. This opinion is confirmed by measurements which I have carried out of a thousand examples of the parasite. A percentage curve made from these measurements corresponds closely in its shape with a similar curve made by Sir David Bruce for the *Trypanosoma vivax* of Uganda. A point of interest is that certain rabbits and white rats were infected from this strain.

It was, at the time of writing the previous report, an open question whether the short form of parasite found in the horse was a distinct species of trypanosome or merely a modification of the long form. By means of the animal reactions I have been able to separate these forms. From these reactions, as well as by its morphology and its measurements, I have come to the conclusion that this short trypanosome belongs to a different species entirely, and has no relationship, except in this case their common animal host, with *Trypanosoma vivax*. Although at first the animal reactions of this short parasite were such as to resemble very little the reactions of the short form of *Trypanosoma dimorphon*, a great increase in its virulence has occurred, and I feel justified now in assigning it a place as *Trypanosoma dimorphon sensu* Laveran and Mesnil. This horse then was not suffering from an infection by the double-formed trypanosome originally described by Dutton and Todd, but has proved to be a host for two distinct species of trypanosome. This is of importance, because so far as I am aware all observers have failed to discover a trypanosome identical with that originally described by Dutton and Todd, and it has been suggested that possibly they were dealing with a double infection, comparable to such a double infection as existed in this horse from the same region.

A number of experiments have been made by me to ascertain how long trypanosomes can retain their vitality in the dead body of the animal host. As a result of these experiments, it appears that *Trypanosoma gambiense* and *Trypanosoma rhodesiense* can remain alive and infective in the blood of an animal after its death for at least 48 hours.

A series of experiments has been made with *Piroplasma canis*. The object of the experiments was to discover whether the serum of dogs which had apparently recovered from infection with *Piroplasma canis*, or were suffering from a very chronic infection, can confer any immunity against infection when injected into healthy dogs or can cure dogs when infected with *Piroplasma canis*. The results of the experiments failed to show that there was any action, protective or curative, on the part of such serum.

The following papers have been published from these laboratories during the last six months :—

(1) W. Yorke and B. Blacklock. The Trypanosomes found in Two Horses Naturally Infected in the Gambia. Annals of Tropical Medicine and Parasitology, Vol. V., No. 3, December, 1911.
(2) W. Yorke. The Passage of Hæmoglobin through the Kidneys. Annals of Tropical Medicine and Parasitology, Vol. V., No. 3, December, 1911.
(3) B. Blacklock. The Measurements of a Thousand Examples of *Trypanosoma vivax*. Annals of Tropical Medicine and Parasitology, Vol. V., No. 4, February, 1912.
(4) B. Blacklock. A Note on the Measurements of *Trypanosoma vivax* in Rabbits and White Rats. Annals of Tropical Medicine and Parasitology, Vol. V., No. 4, February, 1912.
(5) J. O. W. Barratt and W. Yorke. Ueber Hamoglobinämie. Zeitschrift für Immunitätsforschung und experimentelle Therapie. Zwölfter Band. Drittes Heft, 1912.
(6) B. Blacklock. The Vitality of, and Changes Undergone by, Trypanosomes in the Cadaver of the Animal Host. Annals of Tropical Medicine and Parasitology, Vol. VI., No. 1*b*, May, 1912.

I have, &c.,
B. Blacklock, M.D., D.P.H.,
Acting Director.

The Secretary,
Incorporated Liverpool School of Tropical Medicine.

Enclosure 3 in No. 1.

Department of Medical and General Economic Entomology.

Sir, 6th May, 1912.

I have the honour to submit herewith a report for the half-year ending April 30th, 1912.

A. Expedition to Nyasaland.

As a member of the Commission appointed by the Colonial Office, under the direction of the Royal Society of London, to enquire into the relation of the African Fauna and its possible maintenance and spread of human trypanosomiasis, I proceeded to the Nyasaland Protectorate on June 8th, 1911, and was absent for a period of five months. During my stay in the Protectorate my attention was devoted almost exclusively to the bionomics of the tsetse-fly, *Glossina morsitans*, with the view of discovering its breeding-grounds and devising some means of checking its spread.

Dr. J. B. Davey, Medical Officer, was officially appointed as my assistant, and I wish here to express my indebtedness to him for the excellent services which he rendered, and my warm appreciation of the able way in which he conducted his researches.

A brief summary of the results obtained was forwarded to the Colonial Office and also to the Royal Society under date 13th November, 1911, of which the following is a summary with certain minor alterations :—

(1) That the breeding-places or pupal habitat of the tsetse-fly *Glossina morsitans* were discovered in three separate spots in the forest about 1½ miles from the banks of the Shire River at a place lying about 18 miles due north of Liwonde. The pupæ were found buried in soil at the foot of various trees.
(2) That the breeding-habits were fully observed in the Laboratory.
(3) That examples of *Glossina morsitans* were found in the food contents of two species of birds, viz. : The common African Drongo (*Dicrurus afer*) and a small Bee-eater.
(4) That a careful study of the internal anatomy of *Glossina morsitans* was made and compared with that of *Glossina palpalis*.

(5) That so far as our experience goes at the present moment we found that this tsetse-fly was most abundant in those portions of the forest where Sanya trees and the Inswala or Impala Antelope (*Æpyceros malampus*) were most abundant.

(6) That the flora so characteristic of the " dambo " did not harbour the fly to any marked extent, indeed open country seems inimical to the propagation of this insect.

(7) That the colours found most attractive to the *Glossina morsitans* were khaki and yellowish green—white being, so far as we could ascertain, the least attractive of all.

(8) About 70 post-mortem examinations of birds were made and the food contents of the stomachs were tabulated. In many instances the skins were preserved for future reference and identification, more especially so were those of the insectivorous kinds.

(9) A large series of specimens, drawings, and photographs illustrative of the bionomics of *Glossina morsitans* were also prepared.

(10) Observations on the relative abundance of wild game, birds, &c., and the physical features of the country were also noted. These and all other matters in relation to the work of the investigation will be dealt with in the full Report, which will be completed early in June next.

B. Students.

1. The usual courses of instructions were given to the students attending this School for the Diploma in Tropical Medicine. The number of students attending these courses were :—

For the Autumn Term, 13.
For the Lent Term, 19.

2. For the Special Course in Medical and Economic Entomology the number of students were :—

For the Autumn Term, 6.
For the Lent Term, 1.

C. Additions to Museum.

Dr. H. Wolferstan Thomas : A collection of mosquitos from Manaos.

Dr. Mackay : A collection of miscellaneous Diptera from British Honduras.

Dr. Flood : Tsetse flies and Tabanids from N. Nigeria.

Dr. M. W. Manuk : Tsetse flies and other biting Diptera.

Dr. Neiva : *Conorhinus megistus*—eggs, larvæ, nymphs, and adults.

Dr. J. C. Murphy : A collection of mosquitos, tsetses, tabanids, and other biting insects from Sierra Leone.

Dr. J. Ross : Tsetse flies from Northern Nigeria.

Professor M. Miyajima : Slides of Aphaniptera.

F. V. Theobald, Esq. : A collection of Culicidæ including 8 types and 7 paratypes of recently-described species.

Entomological Research Committee (T.A.) : An example of *Bembex forcipata* and its prey; also specimens of tsetse flies, Stomoxys, Tabanids, mosquitos, &c.

Dr. J. W. Scott Macfie : Three specimens of Glossina, including *G. tachinoides* in the act of parturition.

R. P. Filleul, Esq. : One specimen of a tsetse-fly, possibly a new species, from Jubaland, British East Africa.

Dr. M. Sanderson : Specimens of *Glossina brevipalpis.*

Dr. D. P. Oakley : Specimens of *Glossina fusca* from the Gold Coast.

Captain Keane, R.A.M.C. : Twelve infected specimens of *Ornithodoros moubata.*

I have, &c.,
ROBERT NEWSTEAD,
Dutton Memorial Professor of Medical Entomology.

The Secretary,
Incorporated Liverpool School of Tropical Medicine.

Enclosure 4 in No. 1.

DEAR SIR, Johnston Laboratory, University of Liverpool, 1st May, 1912.

I BEG to enclose the report of Dr. G. C. E. Simpson on his chemical researches done in connection with the special grant made by the Advisory Committee for the Tropical Diseases Research Fund for this work.

I am, &c.,
RONALD ROSS.

The Secretary,
Liverpool School of Tropical Medicine,
Liverpool.

Chemical Laboratories, Liverpool School of Tropical Medicine,
SIR, University of Liverpool, April 26th, 1912.

IN accordance with your request I have much pleasure in submitting a report for the Advisory Committee of the Colonial Office on the work carried on in this Department since the renewal of the grant for research in chemical pathology in January, 1912.

I. Beri-Beri.

The major part of the time has been devoted to the continuation of the investigation of the antineuritic substance present in unmilled rice and other grains and foodstuffs, and important in the prevention and cure of beri beri.

The antineuritic principle of yeast has been isolated in a fairly pure condition. The substance appears to be a base, containing a trimethylamine group, and probably allied to neurin. Two grams were obtained from 50 kilogrammes of yeast. A daily dose of one milligramme appears to prevent polyneuritis in pigeons fed on polished rice.

A paper on the subject is now in the Press in conjunction with Professor Benjamin Moore and others, and we hope to continue our investigations into this question in order to elucidate the following problems if possible :—

(1) The exact composition of the antineuritic base of yeast.
(2) The condition in which it is present in the original grain.
(3) The preparation of sufficient quantities for use as a drug for the treatment of beri-beri.
(4) Its identity with or relationship to the antineuritic substances of various grains and other vegetable and animal foodstuffs.

(The provisional formula of the substance in rice isolated and described by Funk (Jour. Physiology, Dec., 1911) differs from that assigned to the substance isolated from yeast by us.)

II. Malaria.

The examination of the blood of malarial cases for a hæmolytic principle has been continued, but a sufficient number of positive results for analysis and examination have not yet been obtained.

The investigation of the hæmolytic action of quinine in healthy persons is being continued as opportunity offers, but the results require further examination as there seem to be individual differences.

Work is being continued on the above lines, and is also projected or commenced on :—

(1) Investigation of drugs of the quinine group on malarial patients with a view to determining the active radical of the quinine molecule (in conjunction with Dr. David Thomson).
(2) The presence of antibodies or Wasserman bodies in malarial fever.
(3) Phagopyrism.
(4) Larvicides (in conjunction with Dr. Blacklock).

I am, &c.,
G. C. SIMPSON.

Sir Ronald Ross, K.C.B., F.R.S.

No. 2.

THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 1 November, 1912.)

SIR, B 10, Exchange Buildings, Liverpool, 31st October, 1912.

I HAVE the honour to enclose, for the information of the Tropical Diseases Advisory Committee, the following reports of the Liverpool School of Tropical Medicine for the six months ending 31st October, showing the manner in which the Government grant to the School has been expended, viz. :—

(1) Report of the Walter Myers Lecturer of the School (Dr. J. W. W. Stephens).
(2) Report of the Acting Director of the Runcorn Research Laboratories of the School (Dr. B. Blacklock).
(3) Report of the Professor of Medical and Economic Entomology (Professor R. Newstead).
(4) Letter from Sir Ronald Ross, enclosing report by Dr. G. C. E. Simpson on his chemical researches done in connection with the special grant made by the Advisory Committee for the Tropical Diseases Research Fund for this work.

I am, &c.,
A. H. MILNE,
Secretary.

Enclosure 1 in No. 2.

SIR, 30th October, 1912.

I BEG to submit the following report on the work done during the period from May 1st to October 31st, 1912 :—

Students.—The number of medical men who attended the June Short Course was 8, and for the Autumn Term, 13. Total, 21. These include members of the Royal Army Medical Corps, Indian Medical Service, West African Medical Staff, Colonial Medical Service, &c.

Diploma of Tropical Medicine.—During the last six months no examination for the diploma has been held. The next examination takes place on December 16th.

Museum.—The thanks of the School are due to the following gentlemen for their kindness in sending specimens to the School during the last six months :—

Captain P. K. Tarapore, I.M.S., Burma; Major J. Davidson, I.M.S., Dehra Dun; Miss M. V. Lebour, Leeds; Mr. H. F. Carter, Liverpool; Dr. S. Bell, Hong Kong; Dr. Bowie, Shetland; Dr. Wise, Georgetown, British Guiana; A. M. Macfarlane, Esq., M.R.C.V.S., Marsa, Malta; Dr. Scott Macfie, Northern Nigeria; Dr. F. C. Madden, Cairo; Professor Miyajima, Tokio; Dr. J. M. Taylor, Uganda; Dr. Broden, Brussels.

RESEARCH WORK.

Trypanosoma rhodesiense.—As stated in our last report, Dr. Fantham and I measured 1,000 *T. rhodesiense* from a single rat, and the curve obtained by this method agreed with the curve of 600 trypanosomes obtained from several rats. We can also state that these two curves agree closely with the curve based on a variety of animals obtained by Surgeon-General Sir David Bruce of *T. rhodesiense* from Nyasaland. The method used by us in measuring one thousand trypanosomes is to measure 100 each day for the first ten days of infection. We have proceeded since to measure 1,000 *T. gambiense* in the same way from a single rat to ascertain whether it were possible by this means to distinguish the two trypanosomes. Unfortunately it has not been so. The curve obtained by us for *T. gambiense* so closely resembles that obtained by us for *T. rhodesiense* that we are unable to distinguish the two trypanosomes by this means. We hope shortly to publish both these curves. It is perhaps not out of place to mention here that a trypanosome from Rhodesia, presumably *T. rhodesiense*, has also recently been measured by Kinghorn and Yorke. Their

curves, however, bear no resemblance to the curve of *T. rhodesiense* obtained by ourselves and Bruce. They resemble rather the curve of *T. gambiense* obtained by Bruce, which again differs from our curve of *T. gambiense.* Either, then, we are dealing in some of these cases with different trypanosomes, although morphologically the same, or the difference depends upon the difference of the method, viz., in our case using one animal, and in other cases various animals. In the last series of measurements made by us we have used one animal, namely, the rat, in order to avoid any unknown source of error from using various animals.

Morphology of Trypanosoma rhodesiense.—As shown by Bruce and others in their recent papers, the sleeping sickness of Nyasaland is due to *T. rhodesiense*, and is not the same as the sleeping sickness of Uganda and elsewhere, which is due to *T. gambiense.* With regard to the morphology, we originally were able to distinguish this trypanosome from *T. gambiense* by the fact of the posterior nucleus of some of the short stumpy forms. Recently, however, it has been shown that posterior nuclear forms occur in the trypanosome known as *T. pecaudi*, in *T. equiperdum*, and in *T. brucei*, so that this peculiarity, although sufficient to distinguish it from *T. gambiense*, does not suffice to distinguish it from these other three trypanosomes. It remains to be seen, then, what the relationship of *T. rhodesiense*, *T. brucei*, *T. pecaudi*, and *T. equiperdum* is to one another.

Method of measuring trypanosomes.—Criticism has recently been brought against our method of measuring trypanosomes. It has been stated that our method of projecting trypanosomes and tracing them in a dark room instead of drawing them with a camera lucida is a "counsel of perfection" for the tropics. We are not aware that we ever recommended this method for the tropics, but simply stated that it has advantages over camera lucida drawing, and we see no reason why we should be precluded from using it in this country. Criticism has also been brought against the actual method of measurement used by us, namely, the "tangent method," but our critics ignore entirely our main objection to the compass method, namely, that it does theoretically and does actually give a measurement less than the true one. If one draws on a piece of paper a zig-zag line, say, 18 inches long, the limbs of which are, say, 3 inches each, it will be found that it is impossible to measure this zig-zag accurately with a compass set at any other distance than 3 inches or a factor thereof. If, for instance, the distance between the compass points is 2 inches, the length of the zig-zag is about 12 inches, when the angle between the limbs is about 45 degrees; it will be much less if the angle is still more acute. And again, if the compass is set at 4 inches it will be found that the length of the zig-zag will be about 9 inches only instead of 18 inches, when the angle between the limbs is 45 degrees, and still less when the angle is still more acute. So that unless the distance between the compass points is equal to that of the limbs it is impossible to obtain even an approximately correct measurement. Consequently, in a zig-zag line of which the limbs are unequal it is absolutely impossible to measure the distance accurately with a compass the points of which are fixed. Now, the principle of this objection applies equally to measuring trypanosomes with a compass with fixed points, as it is quite clear that an accurate measurement cannot be got, but on the contrary, we believe that by the use of the tangent method a very accurate result is possible. We also stated that the method was equally applicable to spirochætes or any other curved line, and in this case we believe that the compass method would be even still more inaccurate than in the case of trypanosomes where the variations in the curves are not so acute as in the case of spirochætes. Our critics have entirely ignored our main objection on this point, and confine their criticism solely to a subsidiary objection which we made to the method, namely, that one is never certain, when using a compass with fixed points, that one finishes exactly at the end of the object measured. The error, no doubt, as they point out, may be small, but still it is another error added to the initial error of measurement. We maintain, therefore, that it is worth while using a more accurate method instead of a less accurate one, especially if the length of a trypanosome is a criterion of specificity.

Publications:

(1) Stephens, J. W. W. (1912): *Paropisthorchis caninus*, the liver fluke of the Indian pariah dog. Annals of Trop. Med. & Parasit., Vol. VI., No. 1 B., plates x-xii.

(2) Stephens, J. W. W. and Fantham, H. B. (1912): The Measurement of *Trypanosoma rhodesiense.* Proc. Roy. Soc., B., Vol. 85, pp. 223-234, 1 plate.

(3) Stephens, J. W. W., and Fantham, H. B. (1912) : *Trypanosoma rhodesiense* (Stephens and Fantham). A second species of African trypanosome producing sleeping sickness in man. Brit. Med. Jour., Nov. 2, 1912.

Ghent Exhibition.—At the request of the Colonial Office the School has undertaken to send a tropical exhibit to the International Exhibition at Ghent in 1913. The School is making itself responsible for an exhibit in the following subjects, which will be prepared by Professor Newstead and myself : malaria, sleeping sickness, yellow fever, and ankylostomiasis.

I am, &c.,
J. W. W. Stephens.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings, Liverpool.

Enclosure 2 in No. 2.

Sir, Research Laboratories, Runcorn, October 31st, 1912.

I have the honour to submit to you this report on the work done at the Runcorn Research Laboratories of the Liverpool School of Tropical Medicine, during the period from May 1st to October 31st.

The Grant has been expended on the upkeep of the laboratories, on the purchase and maintenance of the animals required for the purposes of preserving the various strains of trypanosomes, piroplasma, and spirochætes, and in carrying out research.

With reference to the trypanosomes found in a horse from the Gambia, mentioned in my previous report, the study of the second form of trypanosome has been continued. The measurements of it tend to confirm the opinion arrived at as a result of the animal reactions, that this short form is *T. dimorphon* (*sensu* Laveran and Mesnil).

Recently, I have examined a strain of *T. equiperdum* obtained from Professor Schilling. In this strain there was noted the occurrence of trypanosomes which have a position of the nucleus posterior to the centre. In our old laboratory strain of Dourine this peculiarity had been noted, and, as Professor Schilling's (Dr. Yorke) strain came from the same source as our old laboratory strain, it seems that this phenomenon is constant in this particular strain of animal trypanosome.

A similar phenomenon has also been observed by me in a strain of *T. brucei* from Uganda.

These facts appear to be of considerable importance, as the presence of trypanosomes having a posterior position of the nucleus constituted the characteristic upon which Stephens and Fantham founded their new species of human trypanosome, *T. rhodesiense.* It would appear that the presence of posterior nucleated trypanosomes is not confined to *T. rhodesiense,* but is also observed in other trypanosomes which affect animals. In this connection it may be noted that Wenyon (Sleeping Sickness Bulletin, 1912, No. 39, p. 262) discovered similar forms in *T. pecaudi.* As the strain of Dourine referred to came from Algiers, while Wenyon's *T. pecaudi* was obtained in Sudan, and the *T. brucei* with which I was dealing came from Uganda, it appears that parasites having this posterior position of the nucleus are widely distributed geographically. They have, so far, been described in the human and animal trypanosomiasis of Rhodesia, in the human trypanosomiasis of Nyasaland and of Portuguese East Africa, in *T. pecaudi,* in *T. equiperdum,* and *T. brucei* (Uganda).

During the past six months I have been carrying out experiments upon the Ecto-parasites of man and animals at the request of Sir Ronald Ross, with a view to discovering a cheap and effective means of dealing with them.

The following papers have been published from these laboratories :—

(1) B. Blacklock. The Measurements of a Thousand Examples of a Short Form of Trypanosome from a Double Infection. Annals of Trop. Med. and Parasitology, Vol. VI., No. 2, July, 1912.

(2) W. Yorke and B. Blacklock. A note on the Morphology of a Strain of *Trypanosoma equiperdum.* British Medical Journal, August 31st, 1912.

(3) B. Blacklock. On the Presence of Posterior Nucleated Parasites in a Strain of *T. brucei.* British Medical Journal, October 19th, 1912.

(4) B. Blacklock. On the Resistance of *Cimex lectularius* to Various Reagents, Powders, Liquids, and Gases. Annals of Tropical Medicine and Parasitology (shortly to appear).

(5) B. Blacklock. The Resistance of *Ornithodorus moubata* to Various Sheep-dips. Annals of Trop. Med. and Parasitology (shortly to appear).

I have, &c.,

B. BLACKLOCK, M.D., D.P.H.,
Acting Director of the
Runcorn Research Laboratories.

The Secretary,
Liverpool School of Tropical Medicine,
Liverpool.

Enclosure 3 in No. 2.

DEPARTMENT OF MEDICAL AND GENERAL ECONOMIC ENTOMOLOGY.

SIR, 29th October, 1912.

I HAVE the honour to submit the following report for the half-year ending October 31st, 1912 :—

Students.—1. The usual courses of instruction were given to the students attending this School for the diploma in tropical medicine. The number of students attending the courses were :—

For the Summer Term (Short Course), 8.
For the Autumn Term (Full Course), 12.

2. For the Special Course in Medical and Economic Entomology for Colonial Officers and others, there were present :—

Summer Term (June, 1912), 8.

3. A course of lectures and demonstrations have also been given to the undergraduates and post-graduates in the Veterinary Department of the University.

4. Two research students, advanced in the science of medical entomology, have devoted considerable time to the study of the mosquitoes (Culicidæ) and tsetse flies (Glossina) comprised in the extensive collections of the School.

5. A short course of lectures in general and economic entomology was given to the undergraduate students in the Department of Zoology during the summer term.

Reports and Publications.—1. A full report on my expedition to Nyasaland dealing with the bionomics of the tsetse fly *Glossina morsitans* has been completed.

2. The description of a new tsetse fly, *Glossina austeni*, Newstead, from Jubaland, British East Africa, was published in the Annals of Tropical Medicine and Parasitology, Vol. VI., No. 1 B., p. 129 (May 29th, 1912).

3. The structural characters of the male genital armature of *Glossina austeni*, Newstead; *G. longipennis*, Corti; and *G. fuscipleuris*, Austen, have been described and figured by me for publication in the Bulletin of the African Entomological Research Committee. This paper is in the hands of the Editor and awaits publication.

4. A descriptive account of all the known species of the papataci flies (Phlebotomus spp.) of Africa, including the descriptions of two species new to science, with illustrations, has been completed, and awaits publication in the Bulletin of the African Entomological Research Committee.

Identification of blood-sucking insects, &c.—The following is a summary of the number of species and specimens identified by myself and my assistant, Mr. H. F. Carter, during the past six months. These include several small collections from the Congo Free State and other parts of Africa, South America and the West Indies, India, and the British Isles :—

	Species.	Specimens.
Mosquitoes (Culicidæ)	122	1,664
Papataci flies (Phlebotomus spp.)	5	70
Horse flies, &c. (Tabanidæ)	18	91
Tsetse flies (Glossina spp.)	19	511
Scale insects (Coccidæ)	34	—
General economic entomology	30	62
Total	228	2,398

Additions to the Museum Collections.—We are considerably indebted to the following gentlemen who have been pleased to present to us collections of blood-sucking insects for demonstrative and other purposes :—African Entomological Research Committee, per Mr. Guy A. K. Marshall; Dr. H. Wolferstan Thomas, Brazil; Mr. R. P. Filleul, District Commissioner, Jubaland; Dr. Anna Fedorowitch, Russia; Dr. J. Bruce, Portuguese East Africa; Captain R. Markham Carter, India; Major S. R. Christophers, India; Dr. G. E. H. Le Fanu, Gold Coast; Dr. W. S. Clark, Southern Nigeria; Dr. H. T. Palmer, West Africa; Dr. A. Ingram, West Africa; Dr. A. Bremner, West Africa; Major E. L. Perry, Punjab, India; and Dr. Best, Calabar; Dr. A. D. Milne, Nairobi, British East Africa.

I have, &c.,
ROBT. NEWSTEAD,
Professor of Medical and Economic Entomology.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings, Liverpool.

Enclosure 4 in No. 2.

Johnston Tropical Laboratory, University of Liverpool,
29th October, 1912.

DEAR SIR,

I BEG to enclose the report of Dr. G. C. E. Simpson on his chemical researches done in connection with the special grant made by the Advisory Committee for the Tropical Diseases Research Fund for this work

I am, &c.,
RONALD ROSS.

The Secretary,
Liverpool School of Tropical Medicine,
Liverpool.

Chemical Laboratories,
Liverpool School of Tropical Medicine,
University of Liverpool, October 26th, 1912.

SIR,

IN accordance with your request I have the honour to submit a report for the Advisory Committee of the Colonial Office on the work carried on in this Department since May, 1912.

I. *The hæmolysis of malaria.*—The investigation of the metabolism of the blood in malaria has been continued. It has been shown that the serum of malarial patients may possess the power of hæmolysing normal red blood cells. The hæmolytic effect cannot be obtained at all periods of the paroxysm nor in every case; the hæmolysis appears to be produced at the period of sporulation and rapidly disappears; it is most likely to be found at the onset of the paroxysm in simple tertian cases when large numbers of parasites have just sporulated.

II. *Quinine in malaria.*—The action of quinine and of hæmolytic drugs on animals and man has been further investigated. Hæmolysis in the body is shown by increased excretion of urobilin; quinine resembles such hæmolytic drugs as antipyrin and toluene-diamine in causing increased excretion of this blood derivative when administered in therapeutic doses to animals. Similar increased excretion of urobilin has also been found in man, though individual susceptibility appears to modify this action. This action may prove to explain some of the cases of blackwater fever after quinine. Blackwater fever has been recorded after administration of antipyrin and sulphonal to cases of malaria. These drugs are known to be hæmolytic, as are many of the quinolin derivatives, such as thallin and kairin. These latter drugs have been found by Dr. David Thomson to have little value in cases of malaria in the Royal Southern Hospital.

III. *The Pyrexia of malaria.*—Dr. Brown, of Carolina, has stated that a chill and fever similar to the malarial paroxysm are caused by intravenous injection of alkali hæmatin in animals. This pigment is formed in the infected corpuscles and liberated on sporulation.

Experiments are being conducted on these lines and on other problems connected with the disease.

IV. *Larvicides.*—In a paper from the School the use of potassium cyanide for destruction of mosquito larvæ was advocated. Further investigations have been made.

The effect of solutions of potassium cyanide on mosquito larvæ is modified by various considerations : the depth of the pool, the exposure to sun and wind, and the purity of the water are important. This is well shown by the following two experiments :—

In pond water in a broad, shallow dish fully exposed to sun and wind many larvæ (pupæ) survived over 18 hours in a solution of 1 part of cyanide in 1,600 parts of water, and numerous mosquitoes hatched.

In a tall, deep jar, sheltered from sun and wind, mosquito larvæ and pupæ were all killed by exposure to a solution of 1 part of cyanide in 100,000 of clear water in eighteen hours.

Under average conditions practically all young larvæ will be killed by exposure to 1 in 100,000 for twenty-four hours. The older forms (pupæ) are much more resistant, but very few will survive exposure to a strength of 1 in 25,000 for twenty-four hours, and 1 in 16,000 is still more reliable.

These strengths correspond to 1 grain in 3 and 2 pints respectively, so that a fatal dose would be unlikely. A pool 3 feet across by 1½ feet deep (1 metre by ½ metre) would require about half an ounce of cyanide.

The action of sanitas as a larvicide is subject to the same modifications by sun and wind, &c., as cyanide. The strength for true larval forms is about 1 in 20,000, but the pupæ resist strengths as high as 1 in 4,000.

Potassium permanganate is almost useless, and very large amounts of carbolacene are needed to affect the larvæ.

V. *Diseases of nutrition, beri-beri, scurvy, &c.*—A paper has been published, in association with Professor Moore and others, on the isolation of the antineuritic substance of yeast so valuable in the cure of beri-beri. The isolation of larger amounts of this substance is being proceeded with in order to investigate more closely its constitution and action on the system. An attempt to isolate antineuritic substances from milk has yielded no result.

Scurvy is a disease in many ways analagous to beri-beri, and a series of experiments on experimental scurvy have been made, chiefly on the lines indicated by Axel Holst and Fröhlich.

In guinea-pigs our results confirm these observers. No scorbutic symptoms were produced in animals fed on milk or sterilised milk alone. A diet of cereal foodstuffs (oats) causes the development of scorbutic lesions, and the addition of sterilised milk to the diet slightly delays the onset. Fresh, pure milk is much more efficacious than sterilised milk, though it does not, in all cases, prevent the scurvy. Experimental scurvy may prove to differ from such diseases as beri-beri; the latter appears to be due to a simple deficiency of antineuritic substances in the diet. In oats and cereals there is no antiscorbutic substance; in sterilised milk there is no antiscorbutic. Guinea-pigs fed on the latter do not develop symptoms of scurvy, however. It appears that oats and cereals contain a scorbutic principle alone, that fresh milk contains an antiscorbutic, while sterilised milk has neither scorbutic nor antiscorbutic principles. Antiscorbutic properties are also clinically and experimentally found in the outer parts of the potato, as in fresh vegetables and lime juice.

The study of experimental scurvy would seem to indicate that feeding infants on sterilised milk will rarely cause scurvy unless some cereal food is also given; should such foods be given, care must be taken that sufficient antiscorbutic food is also administered.

Pellagra.—Many considerations favour the conclusion that the disease may prove to be a disease of nutrition. Raubitshek and others have claimed to produce an experimental disease analagous to pellagra by feeding albino animals on maize, and exposing them to the influence of sunlight. Other observers have criticised the experiments and their bearings on pellagra.

A consideration of the lesions of pellagra and phagopyrism in the light of our knowledge of beri-beri led to the hypothesis that the skin lesions of pellagra might be due to a neuritis affecting particularly the sensory nerves. In that way the skin might be rendered particularly susceptible to the sun rays or less resistant to trauma.

In the hot summer of 1911 we subjected albino and other animals to direct sun light while on maize diet for a period of 4½ months, but failed to produce any lesions.

This year similar experiments with albino animals and controls have been carried on. Both rabbits and guinea-pigs were used and some were fed on whole maize, others on various maize meals.

One rabbit on maize meal developed some eczema of the ears which was rapidly improving under treatment by simple ointment when the animal died (from diarrhœa, apparently epidemic as some of the controls were also affected). No other lesions were found in any of the rabbits in spite of careful search after death, though the duration of the experiment was over six months, and we conclude that in this climate we are unable to obtain the phenomena of phagopyrism.

Two albino guinea-pigs—one on whole maize, the other on maize meal—died about three weeks after the commencement of the experiment. In neither was there any skin lesion, but in both of them there was widespread neuritis of the main nerve trunks, and of the cutaneous branches; in one there were in addition typical scorbutic lesions and spontaneous fractures.

One must conclude that both these animals were affected by scurvy rather than phagopyrism (as Holst has suggested), but the experiment is not without interest, as it shows that exclusive feeding on maize may cause neuritis in guinea-pigs. Guinea-pigs on limited diet are more apt to develop osteoporosis or scurvy than neuritis, and in the experiments on scurvy I found no instance of nerve degeneration in guinea-pigs. Pigeons which develop neuritis on polished rice have been kept in good condition for four months on maize; indeed, a change to maize diet will cure those which are showing early symptoms of neuritis after feeding on polished rice.

The results of these experiments on scurvy and pellagra were in part communicated in the discussion on "The Importance of Minimal Substances in Diet," in the Physiological section of the British Medical Association, July, 1912.

Publications:—

(1) On Hæmolysis in Malarial Fever. Annals of Trop. Med. and Parasitology, Vol. VI., 1912.
(2) On Hæmoglobin Metabolism in Malarial Fever II. The influence of Quinine. Annals of Trop. Med. and Parasitology, Vol. VI., 1912.
(3) The Antineuritic Bases of Vegetable Origin in Relationship to Beri-beri, and a Method of Isolation of Torulin, the Antineuritic Base of Yeast, in association with Professor Moore and Others. Annals of Trop. Med. and Parasitology, Vol. VI., 1912.
(4) The Antineuritic Basis of Vegetable Origin in Relationship to Beri-beri, &c. (in association with Professor Moore and Others). Biochemical Journal, Vol. VI., 1912.
(5) Contribution to Discussion on "The Importance of Minimal Substances in Diet." Lancet, No. 4,642, 1912, p. 462.

Work in progress:—

1. Hæmoglobin metabolism in malarial fever.
   (*a*) The rule of hæmatin in the pyrexia of malaria.
   (*b*) The effect of quinine and its derivatives on the blood.
   (*c*) The hæmolysis of malaria.

(2) The composition and action of the antineuritic substances of diets.

I have, &c.,
G. C. E. Simpson.

Sir Ronald Ross, K.C.B., F.R.S.

APPENDIX VI.

Reports on Work done in Colonial Laboratories.

No. 1.

BRITISH GUIANA.

THE ACTING GOVERNOR to THE SECRETARY OF STATE.

(Received June 25, 1912.)

Government House,
Georgetown, Demerara, 4th June, 1912.

SIR,

I HAVE the honour to transmit a report on tropical diseases research work in the British Guiana Laboratory during the half year ended 31st March, 1912.

I have, &c.,
CHARLES T. COX.

Enclosure in No. 1.

REPORT OF TROPICAL DISEASES RESEARCH IN THE GOVERNMENT BACTERIOLOGICAL LABORATORY, BRITISH GUIANA, FOR THE SIX MONTHS OCTOBER, 1911, TO MARCH, 1912.

By
K. S. WISE, Government Bacteriologist, and E. P. MINETT, Assistant Government Bacteriologist.

1. *Filarial Abscess.*
2. *Granuloma Pudendi in Dogs.*
3. *Preliminary Notes on the Vaccine Treatment of two cases of Leprosy.*

Filarial Abscess.

This is a disease finding frequent expression in this country, which must be considered remarkable in that most of the standard treatises of tropical medicine have but little reference to the subject. Castellani and Chalmers in their excellent Manual write of lymphangitis rarely going on to abscess; with this exception the question of abscess in filariasis is ignored.

Scheube's Hand-book similarly deals with filarial abscess as a rare complication of elephantiasis.

In this, experience in British Guiana agrees; it is, undoubtedly, a rare complication of elephantoid disease, but many deep-seated abscesses occur in filarial subjects apart from elephantiasis or lymphangitis, which are none the less due to filarial worms.

Manson, in Tropical Diseases, points out the connection between deep-seated abscesses and the death of parent filarial worms, and draws especial attention to the danger of such formations in the thorax and abdomen.

Kennard, in this Colony, drew attention many years ago (British Guiana Medical Annual, 1898) to the probable connection between deep-seated abscesses and the death of parent filarial worms. He writes of the condition as " not uncommon," and also remarks especially the presence of blood clots and the general tendency of the cavity to bleed. He was unable to demonstrate the worms in the pus of these abscesses.

Maxwell in the Journal of Tropical Medicine for 1901 writes an illuminating article on the subject, dealing with abscesses of the scrotum, abscesses of the limbs, and abscesses of the abdomen and thorax.

He records twenty-three cases, but out of these he finds remains of an adult *Filaria Bancrofti* in only one abscess, and he is inclined to consider that some are due to a

cause other than the death of the parent worm, especially as regards abscesses of the scrotum. In all but the two last of these twenty-three cases filarial embryos were found in the peripheral blood at night.

The best evidence of these abscesses being filarial is undoubtedly the discovery of the adult worm in the pus. This evidence is, up to the present, usually lacking. A study of the subjoined table (Table 1) will, however, show that in the majority of the cases detailed the parent worm or pieces of it were found.

The abscesses were all deep-seated, and when opened were thoroughly washed out and all the contents completely evacuated. Every drop of fluid and every shred of tissue coming away was carefully collected. The whole of this material from each abscess was passed through a sieve of 14 meshes to the inch, and the resultant solid matter washed thoroughly and teased out to find the worms.

In several instances, more especially when the abscess was large, of long standing with much pus, no doubt the worm was absent because it had been destroyed by proteolytic digestion.

Bacteriological examination of the pus was carried out at the same time, and whereas a few were sterile the majority show that the infection was streptococcal.

TABLE 1.

No.	Race.	Situation.	Character.	Organism.	F. Bancrofti.
1	Black ...	Inner side of right arm.	Not recorded ...	Streptococcus ...	Small piece of a female.
2	Black ...	Inner side of right thigh.	Not recorded ...	Streptococcus ...	Small piece.
3	Black ...	Left axilla ...	Not recorded ...	Streptococcus ...	Nil.
4	Black ...	Outer side left arm.	Much thin pus, little blood.	Staph. pyog. aureus.	Small piece, almost destroyed.
5	European	Left gluteal region.	—	Streptococcus ...	One male, piece of one female.
6	Portuguese	Calf of right leg	Much curdy, thick pus.	Streptococcus ...	Nil.
7	Black ...	Not recorded ...	Much pus, little blood	Streptococcus ...	Nil.
8	East Indian	Inner side left arm.	Much pus, little blood	Staph. pyog. aureus.	Nil.
9	Black ...	Inner side left thigh.	Little pus, much blood clot.	Streptococcus ...	One male, one female.
10	Black ...	Inner side left thigh.	Much thin pus, little blood clot.	Streptococcus ...	Small piece of a female.
11	Portuguese	Not recorded ...	Pus and blood clot, equal quantity, some sloughs.	Streptococcus ...	Large piece of a female.
12	Portuguese	Front of right thigh.	Thick blood and pus, much watery fluid.	Streptococcus ...	Large piece of a female.
13	Black ...	Left calf three abscesses.	Thick pus and blood	Streptococcus ...	Two females in one abscess.
14	East Indian	Front of right thigh.	Much blood, little pus.	Streptococcus ...	One female.
15	East Indian	Left breast ...	Pus and blood, equal parts.	Streptococcus ...	Two females, one male.
16	Black ...	Inner side right thigh.	Much blood, little pus.	Streptococcus ...	Large piece of a female.

No.	Race.	Situation.	Character.	Organism.	F. Bancrofti.
17	East Indian	Left thigh, front aspect.	Much blood, little pus, pieces of muscle.	Streptococcus...	Large piece of a male.
18	Black ...	Left arm, outer aspect.	Much pus, no blood	Staph. pyog. aureus.	Nil.
19	European	Calf of left leg	Blood with points of pus.	Streptococcus...	One male, one female.
20	Black ...	Iliopsoas muscle, post mortem.	Pure blood ...	Sterile	Two males, one female.
21	Portuguese	Left breast ...	Blood clotted with points of pus.	Streptococcus...	Eleven large pieces, at least six worms. Two males and four females.
22	Black ...	Right elbow ...	Much pus	Staph. pyog. aureus.	Two pieces surrounded by pus, one male and one female.
23	Black ...	Left axilla ...	Mixture blood, clot and curdy pus.	Streptococcus...	Pieces of one male and one female.
24	Portuguese	Dorsum, right foot.	Blood only ...	Sterile	Two pieces of two different females.
25	Black ...	At point of left scapula.	Blood only infiltrating the muscles.	Sterile	Pieces of three adults. Sex not stated.
26	Mixed ...	Front aspect of left arm.	Blood clots with points of pus.	Streptococcus...	Piece of one female.
27	Black ...	Left elbow ...	Not recorded ...	Streptococcus...	Nil.
28	European	Calf of left leg	Much curdy pus ...	Streptococcus...	Eight pieces, two males and three females.

It will be seen that in twenty-two out of these twenty-eight cases either complete worms or pieces of worms were found in the abscesses examined.

No doubt in the other six cases greater care or an earlier evacuation of the pus would have discovered this worm. There can be no doubt, therefore, that the adult *Filaria Bancrofti* is a causative factor in these deeper-seated abscesses.

These abscesses are not the result of previous or coincident filarial disease, since in seventeen of these cases the abscess was the first pathological effect of the infection with *Filaria Bancroftii.*

Those eleven cases showing previous filarial disease are as follows :—

TABLE 2.

Disease.	Cases.
Chronic adenitis of filarial origin in the groin.	No. 6, No. 10, No. 16, No. 17, No. 28.
Slight elephantiasis limited to the ankle.	No. 11, No. 12.
Acute lymphangitis recently with no subsequent thickening of limb.	No. 18, No. 21, No. 23.
Severe elephantiasis	No. 24.

The peripheral blood of these patients was not examined at night. Filarial embryos were found in the pus and detritus on seven occasions. It will be agreed

that the embryos are much less protected from destructive influences than are the adults, and that, therefore, if embryos are found present in the abscess there is good reason for believing such abscess to be in an early stage.

It should be noticed that the contents of these seven abscesses in which embryos were found were little pus and much blood or blood-clot, and in two cases sterile blood only was present.

Twenty-one abscesses showed streptococci in pure culture, four *Staphylococcus pyogenes aureus*, while three were sterile.

These cultures were made from a sterile swab inserted in the cavity at the first incision and not from the contents collected as previously described.

The streptococcus obtained from eleven of the twenty-one abscesses in which it was present was further examined as to the special fermentation reactions in various sugars and glucosides.

The following table illustrates the results :—

TABLE 3.

No. of case.	Clotting of milk.	Neutral red.	Saccharose.	Lactose.	Raffinose.	Inulin.	Salicin.	Mannite.
1	X	X	O	X	O	O	O	O
2	O	O	O	X	O	O	X	X
3	O	O	X	X	O	O	O	O
6	O	O	X	O	O	O	X	O
7	O	O	O	X	O	O	O	O
9	X	O	X	X	O	O	O	X
10	O	O	X	O	O	O	X	O
13	O	O	O	X	O	O	O	O
25	X	O	X	X	O	O	X	O
27	O	O	O	X	O	O	O	O
28	O	O	X	O	O	O	O	O

It will be found that milk is occasionally clotted and the disaccharides (lactose and saccharose) are, as a rule, fermented, the polysaccharides (raffinose and inulin) never fermented, the glucosides (salicin) frequently broken up while the hexahydric alcohol (mannite) is sometimes changed. The majority of the streptococcal strains grew readily on nutrient agar and broth; two specimens grew only on glucose agar and in glucose broth. These streptococci may therefore be regarded as *streptococcus pyogenes* (*longus*).

As regards the pathogeny several interesting points should be noticed. The earlier the abscess the less is the quantity of pus, and it would seem from numbers 20, 24, and 25 as though the first occurrence is the production of a blood cyst, in which lie the adults. The adults have not yet been observed alive and moving in such a blood cyst, though further experience will very likely show this. It should be noticed that the blood cyst becomes subsequently infected by the streptococcus (or the pyogenic bacterium). (*See* numbers 9, 14, 16, 17, 19, 21 and 26.) Later on, no doubt, the whole of the blood-clot is invaded and converted into purulent material, and the original cause, the adult *Filaria Bancroftii*, is digested and disappears.

It must not be concluded that the death of an adult *Filaria Bancroftii* leads in every instance to a filarial abscess. As has been shown by Wise (British Guiana Medical Annual, Vol. XVI., 1908) and later by Bahr in Fiji, the death of the worm frequently leads to its calcification.

In this Colony the cretified worm has been observed fifteen times beneath the mucous membrane of the pelvis of the kidneys, four times in the connective tissue of the epididymis, twice in the glissons capsule over the liver and eight times in the inguinal glands. Around these cretified remnants (some of them still half membranous) there is no evidence of the occurrence of a blood cyst, and it is possible that a hæmorrhage around the body of the dead or dying worm is an important factor in the development of a filarial abscess.

The recurrence of these abscesses in the same patient is a common feature, and several of these patients showed four or five scars indicative of previous attacks. One patient who subsequently died of heart failure had seven abscesses (three in the calf of the leg and four in the thigh) one after another in quick succession.

Maxwell (Journal of Tropical Medicine, December 2nd, 1901) draws attention to what he describes as filarial abscess of the cord (spermatic). On this subject work has been done in this Colony and it is probable that this condition as well as the intra-thoracic and intra-abdominal abscess referred to by him are closely allied to or identical with the condition described by Wise in the Report of the Advisory Committee for the Tropical Diseases Research Fund (1907). The condition really is a spreading suppurative lymphangitis, and not a true abscess with a pyogenic membrane.

The spreading purulent lymphangitis is almost always due to a streptococcus, and may involve the lymphatic vessels of the epididymis, spermatic cord, iliac and obturator regions. It may spread up to the retro-peritoneal lymphatics and form a casing over each kidney and lead to acute general peritonitis. It has been observed to pass through the diaphragm into the posterior mediastinum, causing a double pleurisy and invading each axilla. It also discharges purulent material into the venous stream at the opening of the thoracic duct.

Such a severe and dangerous infection has usually a starting point in the epididymis or in the groin glands, and it is there that a dead *Filaria Bancroftii* will be found in a true filarial abscess. It is probable that the abscesses of the cord described by Maxwell and the " endemic funiculitis " of Castellani are similar conditions. A genuine filarial abscess such as is found in the limbs has not yet been observed inside the abdomen or thorax.

Preliminary Notes on the Vaccine Treatment of Two Cases of Leprosy.

The vaccine treatment of two cases of leprosy has been undertaken by means of a culture of Streptothrix Leproides kindly supplied by Captain Williams, I.M.S., from the Parel Institute, Bombay.

The cultures as they arrived here were thin slimy growths of a pale yellow tint on agar.

On sub-cultivation an abundant growth was obtained on various media such as plain agar, glucose agar, acetic agar, and inspissated blood serum.

The above cultures differed greatly, however, quite irrespective of the media employed; for example of four cultures prepared on glucose agar, from the original pure culture, three showed an abundant pale orange coloured growth, whereas the fourth tube showed a white slimy sparse growth.

Examined microscopically the orange-coloured growth contained a mixture of non-acid fast rods and filaments, some of them slightly clubbed, and granules; together with a large number of acid fast granules closely resembling spare formation.

The slimy white growth on the other hand showed microscopically a perfectly homogeneous field of definitely formed well-shaped bacilli, all of them being strongly acid fast.

This pleomorphic power of the organism appears to be well marked and interchangeable irrespective of the media employed or age of the original culture.

After experimenting with various media, with a view to obtaining if possible a culture which was consistent in its characteristics, it was found that a media containing fatty substances gave the best results, various forms were employed such as egg media, oleic acid agar, ova lecithin agar, milk agar, &c. Of these the best results were obtained with milk agar prepared by adding 1cc. of previously sterilised milk to 9cc. of melted sterile agar, well shaking and allowing to cool; this makes a firm cloudy media on which the cultures grow extremely well and are fairly uniform in character. Six tubes of this media were inoculated from a pure culture of the Strept. Leproides, incubated for 72 hours at 37° C. The cultures were then stained by Ziehl Neelsen's method and examined microscopically; the culture showing the greatest uniformity of bacilli and acid fast properties was selected for use as a vaccine.

The culture was scraped from the surface of the media, emulsified with sterile saline, counted against the red blood corpuscles present in normal blood, and standardised. Hermetically sealed glass bulbs of 1cc. capacity were used, containing various strengths from 5 million bacilli per cc. up to 100 millions. The bulbs were sterilised after sealing by heating to 55° C. for one hour on two consecutive days.

Two cases were selected for treatment, both children of parents in a good position in life and exceptionally well cared for.

Case A, a girl aged 13 years with marked thickening of the phalanges lobes of the ear and bluish grey plaques of thickened skin on the cheeks. The case had been examined repeatedly for the presence of lepra bacilli and the probable amount of destruction estimated. On each occasion many bacilli were present, showing a plasmolysis varying from 25 per cent. up to 75 per cent., and also when estimated at different times in the same lesion. Different lesions examined simultaneously often showed varying amounts of plasmolysis.

Up to the present time this patient has received one dose only of 5 millions, subcutaneously into the lax tissue of the flank. No local or general reaction was observed, the patient being kept under careful observation.

Case 2, a boy aged 12 years. This was a case of nodular leprosy, but curiously enough one nodule only can be detected, situated on the centre of the helix of the left ear.

This nodule has been examined repeatedly, and invariably shows large numbers of bacilli present, the amount of plasmolysis present being fairly constant about 50 per cent.

This case has previously been treated with Nastin for a period of 15 months, during which period the nodule at first showed marked signs of atrophy, but later increased in size.

No treatment whatever had been employed for six months when selected for vaccine treatment.

A dose of 5 millions was given; 24 hours later the nodule appeared much flushed and the patient complained of tenderness around the nodule, the temperature rose to 101° F. for a few hours only.

This patient has now received five doses in all, 4 of 5 millions and 1 of 10 millions at intervals of a week. Microscopical examination a week after the first dose showed the presence of many bacilli, the plasmolysis being about 50 per cent.

Beyond the rise of temperature following the first injection, no further constitutional reaction has been observed.

After the first reaction lasting two days, the nodule has atrophied progressively, but as a similar condition has been observed before, it is impossible to say if this is likely to be permanent. Both these cases have been kept under careful observation as to their clinical condition by Dr. E. D. Rowland.

No. 2.

CEYLON.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received March 2, 1912.)

On Tour, Trincomalee, Ceylon,
7th February, 1912.

SIR,

WITH reference to Sir Hugh Clifford's despatch of the 31st July, 1911,* I have the honour to forward herewith, for transmission to the Advisory Committee of the Tropical School Research Fund, a report by Dr. Aldo Castellani, M.D., on research work done in the Clinic for Tropical Diseases and Bacteriological Institute during the half-year ended 31st December, 1911.

I have, &c.,
HENRY McCALLUM,
Governor, &c.

Enclosure in No. 2.

REPORT on Investigation Work carried out at the Clinic for Tropical Diseases and Bacteriological Institute during the period from July 1st to December 31st, 1911, by

ALDO CASTELLANI, M.D.

The routine work has continued to be very heavy at both institutions; during my spare time I have carried out some researches on the following subjects :—

(1) New intestinal bacteria.
(2) New species of endomyces.
(3) " Copra-itch," a dermatitis resembling scabies, caused by a peculiar acarus.
(4) Further observations on the treatment of yaws.

I desire to express here my indebtedness to Mr. E. Burgess for the continuous assistance he has rendered during these investigations.

NEW INTESTINAL BACTERIA.

In continuing the study of intestinal flora of man in the tropics I have observed recently three new species of bacilli, which I have named :—

(1) *Bacillus Giumai.*
(2) *Bacillus Badullensis.*
(3) *Bacillus Talavensis.*

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* No. 5 in Appendix VI. to [Cd. 6024].

B. Giumai.—This is a non-motile, gram-negative bacillus found in a case of appendicitis. On agar, glycerine agar, and serum the growth is like the bacilli of the typhoid and dysentery group. I have called this germ *b. Giumai,* dedicating it to the memory of Giuma, my faithful African laboratory-boy, who greatly helped me during my work in Uganda, and whose sad death from sleeping sickness I have just heard of.

Litmus milk.—Acid, then alkaline.
Lactose broth.—Very slight production of gas.
Saccharose broth.—No acid, no gas.
Dulcite broth.—No acid, no gas.
Mannite broth.—Neither acid nor gas.
Glucose broth.—Acid and gas.
Maltose broth.—Acid and gas.
Dextrin broth.—Acid and gas.
Raffinose broth.—No acidity, no gas.
Arabinose broth.—Acid and gas.
Adonite broth.—Neither acid nor gas.
Inulin broth.—Neither acid nor gas.
Sorbite broth.—Acid and gas.
Galactose broth.—Acid and gas.
Lævulose broth.—Acid and gas.
Inosite broth.—No acidity, no gas.
Salicin broth.—Acid and gas.
Amygdalin broth.—Neither acid nor gas.
Isodulcite broth.—Acid and gas.
Erythrite broth.—Neither acid nor gas.
Glycerine broth.—Acid.
Indol production.—Present.
Serum.—Not liquefied.
Gelatine.—Not liquefied.

The sugar reactions show that the micro-organism is, according to all probabilities, a new species.

Bacillus Badullensis.—This micro-organism was isolated from a case of chronic enteritis, and two cases of normal stools. It is a non-motile, gram-negative bacillus. On agar, glycerine agar, and gelatine the growth is coli-like. It grows abundantly in milk, which becomes slightly acid, and later on alkaline.

The principal sugar reactions are as follows :—

Lactose.—Very slight production of acid and gas
Saccharose.—Acid and gas.
Dulcite.—Acid and gas.
Mannite.—Acid and gas.
Glucose.—Acid and gas.
Maltose.—Acid and gas.
Dextrin.—Slight production of acid and gas.
Raffinose.—Slight production of acid and gas.
Arabinose.—Acid and gas.
Adonite.—Neither acid nor gas.
Inulin.—Neither acid nor gas.
Sorbite.—Acid and gas.
Galactose.—Acid and gas.
Lævulose.—Acid and gas.
Inosite.—Neither acid nor gas.
Salicin.—Acid and gas.
Amygdalin.—Neither acid nor gas.
Isodulcite.—Acid and gas.
Erythrite.—No acid, no gas.
Glycerine.—Slight production of acid and gas.
Indol.—Production of indol very distinct.

The sugar reactions show that this organism is closely allied to the *bacillus pseudocoli*; it differs by not being motile, and by not clotting milk.

Bacillus Talavensis.—This is a motile, gram-negative bacillus. It grows abundantly on all the ordinary laboratory media; it grows well in broth, producing general turbidity without any pellicle. It is typhoid-like on agar. Gelatine and serum are not liquefied. Milk is first rendered alkaline, then it decolourises. The sugar reactions are as follows :—

Lactose broth.—Neither acid nor gas.
Saccharose broth.—Acid.
Dulcite broth.—No acidity, no gas.
Mannite broth.—No acidity, no gas.
Glucose broth.—Acid.
Maltose broth.—No acidity, no gas.
Dextrin broth.—No acidity, no gas.
Raffinose broth.—No acidity, no gas.
Arabinose broth.—No acidity, no gas.
Adonite broth.—No acidity, no gas.
Inulin broth.—No acidity, no gas.
Sorbite broth.—No acidity, no gas.
Galactose broth.—Acid.
Lævulose broth.—Acid.
Inosite broth.—Acid.
Salicin broth.—Acid.
Amygdalin broth.—Neither acid nor gas.
Isodulcite broth.—Neither acid nor gas.
Erythrite broth.—Neither acid nor gas.
Glycerine broth.—Acid.
Indol.—Produces indol.

This micro-organism is closely allied to those of the dysentery group, but for its being motile.

New Species of Endomyces.

The following three new species of endomyces have been found in human stools :—

(1) *Endomyces intestinalis.*
(2) *Endomyces fæcalis.*
(3) *Endomyces entericus.*

Endomyces intestinalis.—Microscopically the organism is identical to *Endomyces tropicalis.* It is gram-positive, does not liquefy gelatine; on serum it grows well without producing the dark pigmentation so commonly found in other endomyces; the medium is not liquefied. Milk is not clotted. The sugar reactions are as follows :—

Glucose.—Production of acid and gas.
Lævulose.—Abundant production of acid, slight amount of gas.
Maltose.—Slight production of acid.
Galactose.—Acidity.
Saccharose.—Acidity.
Lactose.—Neither acid nor gas.
Mannite.—Neither acid nor gas.
Dulcite.—No acid, no gas.
Dextrin.—Neither acid nor gas.
Raffinose.—Neither acid nor gas.
Arabinose.—Neither acid nor gas.
Adonite.—Neither acid nor gas.
Inulin.—Neither acid nor gas.

Endomyces fæcalis.—Gram positive, does not liquefy gelatine, grows well on serum, producing a brown or reddish-brown pigmentation : the medium is not

Sarcoptes of Copra-Itch.

liquefied. Milk is rendered first acid, then becomes decolourised and peptonised. The sugar reactions, very similar to those of *Endomyces tropicalis*, are as follows :—

Glucose.—Production of acid and gas.
Lævulose.—Acid and gas.
Maltose.—Acid and gas rapidly produced.
Galactose.—Acid and gas.
Saccharose.—Acid and gas.
Lactose.—Neither acid nor gas.
Mannite.—Neither acid nor gas.
Dulcite.—No acid, no gas.
Dextrin.—No acid, no gas.
Raffinose.—No acid, no gas.
Arabinose.—No acid, no gas.
Adonite.—No acid, no gas.
Inulin.—No acid, no gas.

Endomyces entericus.—Microscopically the germ is similar to all other endomyces; gram positive, does not liquefy gelatine (3 weeks); grows well on serum, where it does not produce any pigmentation. Milk is rendered strongly alkaline. The following are the principal sugar reactions :—

Glucose.—Acid and gas.
Lævulose.—Acid and gas.
Maltose.—Acid and gas.
Galactose.—Acid and gas.
Saccharose.—Acid and gas.
Lactose.—Neither acid nor gas.
Mannite.—Acid, no production of gas.
Dulcite.—Neither acid nor gas.
Dextrin.—Acid.
Raffinose.—No acid, no gas.
Arabinose.—Neither acid nor gas.
Adonite.—No acid, no gas.
Inulin.—No acid, no gas.

Copra-Itch.

In people having to do with copra—handling it, &c.—in Ceylon, I have very often observed an extremely pruriginous dermatitis, somewhat resembling scabies. I have observed it both in the coolies and in the European supervisors of labour. The term copra is applied to the dried kernels of the cocoanuts; from fresh cocoanuts the kernels are removed, exposed to the sun for a couple of days, then smoked for several days; portion of the kernels crumbles away : copra dust. From the kernels cocoanut oil is prepared and other products.

Clinical symptoms.—The first impression on seeing a patient suffering from copra-itch is that he is suffering from scabies. The hands, arms, legs, sometimes the whole body, except the face, presents rather large, extremely pruriginous papules frequently covered by small, bloody crusts due to scratching; pustules and furuncles may be present. The eruption starts generally on the hands, and from there spreads to the arms, legs and trunk. Pustulation, as already stated, may be present, induced by secondary pyogenic infection caused by the scratching, and the polymorphic appearance of a scabies eruption, consisting of papule vesicles, excoriations, and pustules may be found. In contrast to true scabies no real burrows or cuficuli are found. The sarcoptes of copra-itch does not appear to bury itself in the skin, only on one occasion I found this sarcoptes buried in the papules; it apparently induces the dermatitis in the same manner as *pediculoides ventricosus*, Newport, which lives in diseased cereals, produces an eruption in people handling such cereals; but further investigation is necessary to settle this point.

Duration.—The eruption has, in my experience, very little tendency to heal spontaneously; I have seen cases in which the eruption had been present for three or four months.

Aetiology.—The eruption is due to a small sarcoptes, which, as far as I know, represents a new species. It is larger than *Sarcoptes scabiei*, and is plainly visible to the naked eye. In some samples of copra dust received from infected mills, this sarcoptes was simply swarming, an enormous number of white minute bodies (sarcoptes) being visible moving about. This sarcoptes is 1-2 millimeters in length, has four pairs of legs, and several long, stiff, hair-like formations; the male has a well-developed penis.

Diagnosis.—As already stated the eruption on superficial examination can be easily taken for scabies; true burrows, however, are not present, and the two ascari are morphologically different.

Treatment.—Naphthol and balsam of Peru are, in my experience, very useful in the treatment of the eruption. In adults a 10-20 per cent. beta-naphthol ointment may be used, or balsam Peru and vaseline in equal parts; in children and women the following ointment is very useful, causing very little irritation of the skin :—

Beta-naphthol, grains xxx.
Balsam Peru, drha. 1.
Vaseline, ounce 1.

The ointment should be applied at night after a hot bath.

Further Observations on the Treatment of Yaws (Parangi).

The researches carried out during the last six months confirm the conclusion arrived to in my previous reports. Mercury is of no use in yaws in whatever way given—by pills, by inunction, or by intramuscular injections. Potassium iodide given in full doses is useful in a certain number of cases, the eruption often subsiding, but relapses are common. Brilliant results are obtained by the use of salvarsan (606); in fact, this drug may be considered to be a specific for the malady in *recent* cases. In old chronic cases the results are not so satisfactory, but are better than with any other method of treatment.

Aldo Castellani.

No. 3.

JAMAICA.

The GOVERNOR to the SECRETARY OF STATE.

(Received 17 September, 1912.)

Sir, King's House, Jamaica, 27 August, 1912.

I have the honour to acknowledge the receipt of your Circular despatch, dated the 27th February last,* transmitting copies of the report of the Advisory Committee for the Tropical Diseases Research Fund for the year 1911, and, in compliance with the request made in the second paragraph of your despatch, to transmit herewith, for communication to the Committee, copy of a letter from the Superintending Medical Officer forwarding reports from the Government Bacteriologist and from three District Medical Officers containing their observations on the report.

I have, &c.,
SYDNEY OLIVIER,
Governor.

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* Not printed.

Enclosure in No. 3.

From the ACTING SUPERINTENDING MEDICAL OFFICER to the COLONIAL SECRETARY.

(2091/2150.)

SIR, Island Medical Office, Kingston, 7th August, 1912.

WITH reference to your letter, No. 3654/S.S., Circ. 27/2/12, of the 20th April, 1912, I have the honour to submit the following remarks :—

The Report of the Advisory Committee for the Tropical Diseases Research Fund for 1911 was sent to several District Medical Officers, as well as to the Medical Officers of the Public Hospital, Kingston, and to the Government Bacteriologist for their observations. Drs. Moseley, Turton, and Johnston have sent in reports which are appended hereto.

Dr. Scott has furnished an interesting note on the *Bacillus Serofaciens* which he has been the first to isolate and describe. It may turn out to be of great pathological significance.

Dr. Moseley's remarks on the use of Salvarsan in the treatment of yaws are most interesting and encouraging, and if his results stand the test of time we shall find ourselves in possession of a quick and efficacious remedy for a loathsome and intractable disease. It is, in my opinion, too early yet to make any definite pronouncement on the permanent effect of Salvarsan treatment on yaws, but that the immediate results are marked, and in some instances positively marvellous, is beyond doubt.

Further investigations will have to be made with special reference to relapses, and we shall have to go further into the question of length of time the drug should be excluded, the frequency of administration, and so on.

It will be a great day for Jamaica, with its large yaws population of some 8,000 patients, when we are certain that we have a quick, sure, and permanent cure for the disease. The present system of oral medication, combined with external dressings with the slow, cumbersome, and rather indefinite method of distribution of remedies by district constables, who may use them regularly or irregularly or not at all, is most unsatisfactory, if not positively useless, and every encouragement should, and I hope will, be given to perseverance in the new process.

As regards malaria, the vigorous campaign initiated by the Malaria Commission appointed some two years ago is still being carried on with energy and success. The sale of quinine at a cheap rate at post offices and the free distribution of the drug to school children have had considerable effect in the direction of prophylaxis, which, combined with mosquito destruction and the filling up of swamps, has had the effect of considerably restricting the scope and severity of the disease. It is true that hospital statistics, especially in certain districts, still show a large malarial evidence, but this is found mainly in the institutions where coolies are treated, and this, I think, is largely explainable by the liability of the newly-arrived to contract the disease in their new environments, or at all events to manifest the symptoms of a latent infection; but I think it may be stated without fear of contradiction that, as regards the general native population, malaria is lessening.

Ankylostomiasis may be fairly said to be endemic and, I am afraid, receives fresh strength annually with the arrival of each batch of coolies from India. Measures both curative and preventive are being adopted against this disease. Much may be expected from intelligent and persistent work in the latter direction, which, I may observe, is now engaging attention. The co-operation of the employers of infected labourers, if secured, will be of the greatest value in this respect.

As regards vomiting sickness, our knowledge of its causation and pathology is still most uncertain. The report of Captain Potter, R.A.M.C., who visited the Island last year to investigate the disease is far from conclusive, but he has collected certain facts which will form the basis of future research, resulting, let us hope, in some definite conclusions. The investigation will be prosecuted with energy and during the coming winter.

Peripheral neuritis is another disease whose pathology is still to seek. Its ætiology, treatment, and possible relationship to pellagra offers a fertile field for research, and should furnish a rich and bountiful harvest to the laborious, patient, and persistent seeker after truth.

I have, &c.,
LAWSON GIFFORD,
Acting Superintending Medical Officer.

Honourable Colonial Secretary,
Kingston.

SIR, Port Antonio, 28th May, 1912.

I HAVE the honour to acknowledge the receipt of Circular 885/12, dated the 18th ultimo, forwarding a copy of the report of the Advisory Committee for the Tropical Diseases Research Fund for 1911, for any further information that I might be desirous of furnishing.

"The Lancet," in reviewing this report, mentions that the only note of hesitation as regards the generally recommended measures of hut screening and the preventive distribution of quinine comes from me. The article further refers to the freedom from malaria of railway employees, Customs officials, and others in Italy, who, as the result of living in properly screened houses and verandahs are able to carry on their work during the fever season.

I had no intention to convey the impression that I was opposed to screening; there can be no question as to the utility of it where you have persons behind the screens who recognise the importance of it and who will give their hearty co-operation with a view to keeping it in order.

Racial characteristics as to the observance of sanitary regulations—the preservation of screening among them—is well set forth by Messrs. Deeks and James in their work on hæmoglobinuric fever. They say as regards the three races employed in the construction of the Panama Canal:—

> "The American employees of the Commission are skilled mechanics, clerks, responsible railway employees, &c., &c., &c. * * * * Since January, 1906, almost without exception, they have lived in houses provided by the Commission. These houses are equipped with screen doors, screened windows and verandahs, and are well kept by their inhabitants, any defects in the screening or plumbing being reported promptly."
>
> "Those of the European labourers who so desire live in well kept and carefully screened barracks. * * * * But no amount of advice seems to be effective among them in procuring individual prophylaxis against disease. * * * * They often prefer to sleep in hammocks or even on the ground under their quarters, or other places."

As to the West Indian:—

> "A small percentage only of this race lives in the free quarters provided by the Commission, the rest preferring to live in cheap lodging houses * * * * exposing themselves constantly to the endemic malarial infection there present."

I may mention that "European" has reference to Spanish and Italian labourers in the employ of the Canal Commission, people of other nationalities occupying responsible positions are classed along with the Americans.

That screening, along with measures tending to the abolition of malaria, is followed by excellent results hardly needs further confirmation nowadays. It will, however, be interesting in this connection to mention that the death rate in the canal zone for the month of January of the current year, all classes included, is stated in the report of the Department of Sanitation to have been 13·19 per thousand only, and that during 1909 (Deeks and James) not a single death from malaria occurred among 6,056 American employees.

* * * * * * *

The opinion I expressed as regards the absence of results in the prophylactic administration of quinine to malaria-saturated coolies has been confirmed by Dr. Thomson—see pages 106-7 of the Report. I am strongly in favour of the administration of quinine as a prophylactic measure in the case of the newly-arrived in a malarious country; but the giving to a coolie of a five-grain tablet two or three times a week in the hope that when he is put to heavy work in torrents of rain that he will not develop a malarial attack, I regard as being absolutely futile. Having read Dr. Thomson's report, the reason is perfectly apparent.

The seasonal prevalence of malarial fever among the indentured East Indian immigrants, beginning shortly after the May rains set in and continuing practically to the end of the year, gives the Government and, in fact, all who have to do with them, very grave concern.

The admissions to hospital from among these people, who number about 400 in this district, average about forty per month during the dry months (January to April) of the year. With the advent of the May rains the admission rate rapidly rises, reaching 228 in July last year.

To the layman this means myriads of infected mosquitoes. Want of attention on the part of the Medical Officer " to seek out and destroy the anopheline breeding pools," to quote from one official minute.

I have frequently tried to impress on Government that cases of the sort are not due to fresh infections, but are recrudescences of an existing latent infection.

The position as regards the East Indian immigrant is as follows: They arrive in the Colony usually during the dry season and are immediately located to the estates. I find that considerably over 90 per cent. harbour ankylostoma. A very heavy percentage show unmistakable indications of a chronic malarial infection. They are unaccustomed to work which has to be done often in torrents of rain, from daylight sometimes far into the night. The sick rate is greatest on the estates which from the hilly nature of land are hardest to work and which have the heaviest rainfall.

Search has frequently been made for anopheline breeding pools, but none have been found. The sanitary surroundings of the barracks in which those people live are infinitely superior in every respect to the sanitary surroundings of the dwellings in which the native population live on the adjoining lands, yet the malarial rate among the creole population is not materially increased.

In the canal zone the matter of re-infection or the starting into activity of a latent infection has received very close attention. The opinion held by the very keen observers who are responsible for the health conditions on the isthmus is that the increased sick rate from malaria that accompanies the rainy season is not altogether the result of a fresh infection, but is simply a relapse.

To quote again from Messrs. Deeks's and James's work: "In our opinion this seasonal variation of malaria is due more to relapses than to primary infection or to re-infections. If it were due to primary infections or to re-infections then the number of anopheles mosquitoes should increase synchronously with the increase in rainfall and the increase in the malaria rate and should decline in a similar manner. Mr. Le Prince, the Chief Sanitary Inspector, has informed us that the increase in malaria of each year always ante-dates by several weeks any appreciable increase in the number of anopheles mosquitoes. While it is not easy in countries where malaria is endemic throughout the year to discriminate a relapse from re-infection, Mr. Le Prince's observation demonstrates that a very considerable amount of the June and July malaria must be due to relapses."

" Æstivo-autumnal malaria is very prone to relapse; once acquired it is not easily eradicated, and there are many factors that predispose to relapse at a time when a person who has acquired the infection is exposed to inclement weather."

Æstivo-autumnal parasite is the causative agent in the malaria occurring among the indentured immigrants.

The treatment of yaws by means of Salvarsan has received attention; since the 1st April last year 200 cases have been treated. The method employed is to rub up the Salvarsan with 10 c.c. of sterilised olive oil and inject deeply into the gluteal region. No harmful results have followed except there is considerably inflammatory reaction, adults reacting more severely than children.

The results have been uniformly good, particularly in the acute cases; 30 of the total number treated have been acute. In only one, so far, has it been found necessary to repeat the dose. A coolie child was given a dose in August last year. She had a very extensive primary eruption. All traces of the disease had disappeared within ten days and she left the hospital. About a month ago she returned suffering from periostitis, nodes having formed on either tibia. A further dose of 3 grms. was given; she left a week after, apparently quite recovered.

Some of the best results have been seen in that form of the disease where the soles of the feet are affected—"crab yaws," or, as it is called locally, "Yamunder." Owing to the tenderness of the soles of the feet the sufferers are unable to move about, and I should think would be a distinct danger to healthy persons, inasmuch as they must leave a certain amount of infective matter wherever they step.

Dr. Walter Baetz, of Ancon Hospital, Panama, recently sent me two interesting slides from a case of yaws admitted to Ancon Hospital, the patient being a young Jamaica negro with face ulcers. The slides were stained with Ciemsa, the treponema showing up beautifully.

I have, &c.,
C. A. Moseley,
District Medical Officer.

Sir, Stony Hill, 2nd May, 1912.

In answer to your letter, No. 985/12, I have the honour to submit the following observations:—

Ankylostomiasis.—For the past three years I have paid special attention to this disease. I am convinced that the ill-effects of the infection are far more widespread in the agricultural districts of the Island than is generally realised. It is now common knowledge that an enormous proportion of the labouring class harbour the worm. The gross infection is common enough and forces itself on recognition, but if the theory of the absorption into the system of a toxin excreted by the worm be correct a plausible explanation of the immense amount of temporary physical disability (so common among the barefoot field workers) is furnished.

Putting any theory aside, the actual fact is that cases with no marked anæmia but presenting symptoms that may be covered by the term debility, show no response to ordinary tonic and stimulant treatment until, on examination of a stool, ankylostome eggs are found—it may be only one egg in two or three slides. Specific treatment is instituted with warning as to re-infection, and almost at once a marked improvement sets in, followed by rapid recovery. Such cases have increased in numbers during the past year. It may be that I have been looking out for them and resort to microscopical examination earlier; but, with every desire to avoid the natural tendency to ascribe all sorts and conditions of ill-health to the cause one happens to be interested in, I am forced to the conclusion that the slight infection with the worm is responsible for much of the lassitude and temporary disability to work, leading as it does to poverty and crime.

I take it that the prophylaxis must be educational in its widest sense, institutions and estates being dealt with on recognised lines.

Together with Dr. Macdonald, Medical Officer of Health of Kingston, and Dr. Scott, Bacteriologist to the Medical Department, I have enquired under a Commission issued by His Excellency the Governor into the origin and distribution of typhoid fever in Lower St. Andrew during the past year. That enquiry has brought out clearly the great preponderance of the personal factor in the spread of the disease, as against such chances as water and milk supply; in other words, the disease is spread through ignorance and carelessness in sanitary matters. It is clear that if there is to be any reduction in the number of cases an extension

of the public health organisation must take place, with a careful and continuous application of the sanitary by-laws.

There has been no typical instance of the so-called vomiting sickness during the year in this district; on the other hand, there have been many cases of peripheral neuritis, the cause of which is uncertain.

It is greatly to be desired that the children of the schools should receive, as part of their education, the efficient instructions in the elementary principles of hygiene, otherwise the Public Health Acts do not have a fair chance of doing work which, if it is to be successful, depends in the long run on the co-operation of the people.

I have, &c.,
R. S. Turton,
District Medical Officer.

Sir, Glasgow, Adelphi Post Office, June 4th, 1912.

In reply to your letter of the 18th April, I have the honour to write as follows:—

Dr. Nicholls's admirable report on yaws outlines (page 212) a system for treatment with Salvarsan at moderate cost, some variant of which will no doubt some day be put into effect here; but meantime I would like to say something for the "old" treatment which the brilliant results of Salvarsan administration put, perhaps too deeply, into the shade.

Our present system for public treatment of yaws provides for free supply of drugs and dressings and for examination of cases at monthly intervals until symptomatic cure is obtained, and compels parents or guardians of children so suffering and affected adults to obtain supplies of medicines regularly, severe and intractable cases being encouraged to seek admission to hospital. By this method, the rate of incidence of new cases in a given district can be reduced in one year by four-fifths or more.

And, if hospital accommodation were available for all cases not "curable" by this home treatment and provision made for treating all such with Salvarsan, the system might well be regarded as complete.

In some cases yaws may be as hard to cure as are some cases of syphilis; but the numbers of healthy adults we see who have had yaws in childhood, and, though untreated, have been immune from any further development of the disease, must be remembered as a corrective to deductions from hospital records of "bad" cases. Under our present system we can produce a symptomatic cure and remove infectivity in the majority of cases treated, and, in practice, every case of yaws in a district can be brought under treatment; while, in comparing this with any system requiring stay in hospital, it must be remembered that a considerable proportion of cases would avoid treatment that necessitates absence from home and irksome restrictions.

In reference to oral treatment of yaws, I beg leave to mention that *sp. ammon. aromat* (2-4 minims to each grain of iodide) greatly increases the efficiency of the iodide, probably by retarding its elimination, and also that full doses of *liq. arsenicalis* with an aromatic bitter tincture (*gentiam comp.* or *cinchona comp.*) are, in my experience, of great value. In children, treatment should begin with a thorough course of "worm powder and oil," since practically every child of the class coming under this system has worms. One child. A. T., *æt.* 6 years, examined May 10th, had all four of the common intestinal parasites of this country—*Ascaris L.*, *Oxyuris V.*, *Trichocephalus D.*, and *Ankylostomum D.* In the adult a preliminary purge of calomel and saline is no less necessary. Neglect of this frequently leads to nausea and gastro-intestinal disturbance on taking the "yaws-mixture," and as our peasantry in the main regard yaws as a "God sick," or natural process, any excuse to neglect treatment suffices.

In reference to the note in your letter to the Honourable Colonial Secretary, *re* "Ankylostomiasis fever," I beg to say that, although it has been suggested that the "hectic" evening rise of temperature in these cases is due to absorption of a specific toxin, the innumerable small lesions in the duodenum and presence of decomposing blood in the intestine and reflex irritation are sufficient to account for it. This "fever" is temporarily checked when purgatives and intestinal antiseptics, such as salol and bismuth salicylate are given; and, in my experience, has frequently

led to an incorrect diagnosis of malaria, the true cause only being discovered after quinine has failed to check the fever and progressive anæmia.

The stool in ankylostomiasis may be pale and clay-like or almost black from blood, but is always very offensive and of a peculiar gummy consistence from presence of mucus and fibrin, breaking up with difficulty even when shaken up with water.

As ground-itch invariably accompanies infection and the fact of having had ground-itch [is] easily elicited by questioning, a ready clue to the condition is available, though a severe and advanced case can hardly be mistaken.

In an early case the anæmia may not be marked, but the headache, breathlessness, and palpitation on exertion and progressive weakness soon show themselves, and the other symptoms—the flabby puffy facies, epigastric discomfort, often described as "inward fever," indigestion, and loss of appetite, the furred tongue, often with clean edges and peculiar patches, slight fever and perhaps night sweats, and characteristic changes in the stools—are always present.

This serious disease is evidently spreading rapidly in many districts in Jamaica; and, so long as the present habits of the people obtain, no provision whatever being made for even the "posthole with a heap of earth beside it" at the "ground" or other place of work, seldom even at home, it will continue to do so.

I have, &c.,
HENRY G. JOHNSTON.

The Superintending Medical Officer,
Kingston.

THE HONOURABLE SENIOR MEDICAL OFFICER,

THE only matter which I think would be of special interest to the Tropical Research Committee is the disease associated with the bacillus which I isolated from four cases of obscure fever and which appears to be the causative organism, the *Bacillus Seofaciens*. This was fully described in my report on the work done between October 1st, 1911, and March 31st, 1912, which has already reached the Committee, I suppose.* I have met with two more cases of the same condition, which confirm my previous findings but reveal nothing new.

H. H. SCOTT,
Government Pathologist.

27 June, 1912.

No. 4.

JAMAICA.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received 19 November, 1912.)

SIR, King's House, Jamaica, 31 October, 1912.

I HAVE the honour to transmit, for the information of the Committee of the Tropical Diseases Research Fund, the third half-yearly report by the Government Bacteriologist of this Colony on the work carried out by him during the period 1st April to 30th September, 1912.

2. I beg leave to invite special attention to Dr. Scott's report on cases of vomiting sickness.

I have, &c.,
SYDNEY OLIVIER,
Governor.

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* Not printed.

Enclosure in No. 4.

Third Six-Monthly Report on the Work of the Government Bacteriologist, April 1st—September 30th, 1912.

The Pathological Laboratory,
The Public Hospital, Kingston,
October 3rd, 1912.

Sir,

In accordance with the order of the Right Honourable the Secretary of State for the Colonies, that a report be sent in six-monthly upon the work carried out at the laboratory, I have the honour to present my third report on the investigations at the laboratory during the six months April to September inclusive.

On perusal of the tabular statement appended to this report, it will be seen that an enormous number of specimens has been dealt with, and that full advantage derivable from pathological investigations in connection with clinical medicine and surgery is being taken both by the Medical Officers of the hospital and by practitioners all over the island.

It would be impossible to treat in detail of so large a number in a report such as this, and I find it difficult to select among so many subjects of interest those which most merit detailed description. The following will probably be regarded as the most important :—

I. Enteric Fever.
II. Plague.
III. Anchylostomiasis.
IV. Vomiting Sickness.

A few remarks will also be made upon several other matters which, though important, do not call for such a full consideration as the foregoing.

I. Enteric Fever.

During the six months under consideration 553 specimens of blood have been sent up to the laboratory for examination by Widal's reaction. These are sent, of course, from patients *suspected* of suffering from enteric fever, for most of those obviously ill with that disease are notified as such without bacterial examination, except in the case of the Public General Hospital, where the obvious as well as obscure cases are examined bacteriologically, and at institutions where apparently healthy subjects are tested prior to being set to work in the kitchens, or having anything to do with the food. It is clear, therefore, that the figures revealed by investigations at the laboratory represent in a certain degree only the prevalence of this disease.

Of these 553 specimens 323 gave a positive result, either with *Bacillus Typhosus* or *Bacillus Paratyphosus A*, the only form of *Paratyphosus* apparently common in Jamaica.

The degrees of dilution employed and the limits of time decided upon are 1 in 30 in 15 minutes, 1 in 50 in 30 minutes, and 1 in 100 in 60 minutes, while in some cases a dilution as high as 1 in 1,000 has been used also with a time limit of $1\frac{1}{2}$-2 hours.

In cases where both organisms were agglutinated equally up to 1 in 100, higher dilutions were made, and the specificity of agglutinins present was confirmed, where there was doubt, by Castellani's "absorption method," or, if there was time, by the method of fixation of complement.

The extent to which *Paratyphosus* infection occurs in Jamaica is remarkable, and, so far as I am aware, surpasses considerably the proportion which obtains elsewhere. In my last report it was stated that 33·51 per cent. of positive cases reacted with *B. Paratyphosus* in higher dilution than with *B. Typhosus*; during the last six months 33·1 per cent. of positive results were "*Paratyphosus*."

It was also stated there that it would be erroneous to infer from this fact that such a high proportion constituted "cases of paratyphoid fever," for many sera which gave this reaction were, nevertheless, from typhoid fever patients, or from those who had contracted a double infection, as was proved by culture from the blood or excreta.

The following remarks, however, are based not merely upon these 553 examinations, but on a total of 1,500 made during the past 18 months. The laboratory

being attached to the Public Hospital, I have had, through the kindness of the Medical Officers of that institution, plenty of opportunities for studying at the same time the clinical condition of the patients, and I am particularly indebted to Dr. C. A. Thomson, who has had charge of the enteric fever ward, for affording me the chance of comparing day by day, if need arose, the bacterial findings with the clinical conditions of the various patients under his care.

There is one point of which I particularly wish to write in detail, since I am not aware of its having been treated of elsewhere, and also because it is a matter of interest and, I venture to think, of importance in nearly all cases of enteric fever; that is, the value of the agglutination reaction as an aid in prognosis. Hitherto it has only been used as a means of diagnosis, and from a study of over 1,500 consecutive examinations by this method of Widal, I have come to the conclusion that unless a brief history of the illness is sent with the specimen, there are many pitfalls in the interpretation of the results from a diagnostic point of view. The question of diagnosis of enteric fever by means of the agglutination reaction has been dealt with by numerous authorities, and is mentioned in every text-book on bacteriology, so that this aspect of the matter will only be incidentally touched upon in the following, but from a study of these 1,500 cases, and by frequently testing my results, I venture to submit that we can obtain important information as to the course the disease is likely to take.

To report merely from examination of the serum for power of agglutination, as many practitioners expect, is liable to be most misleading, unless the degree of dilution, the stage of the illness, the previous history, and other points are taken into consideration at the same time.

All sera, then, sent up for examination by Widal's reaction have been tested with both *B. Typhosus* and *B. Paratyphosus*. The following comprise practically all the possible variations which may be met with :—

1. Positive reaction with *B. Typhosus* (*i.e.*, in all the dilutions) :—

    (i.) Agglutination of *B. Typhosus* only.

    (ii.) Agglutination of *B. Typhosus* together with agglutination of *B. Paratyphosus* in low dilution (1 :30).

    (iii.) Agglutination of *B. Typhosus* together with agglutination of *B. Paratyphosus* in high dilution (1 :100, or more).

2. Negative reaction with *B. Typhosus* (in all dilutions) :—

    (iv.) No agglutination of either *Typhosus* or *Paratyphosus*.

    (v.) No agglutination of *B. Typhosus*, but of *Paratyphosus* in low dilution of the serum.

    (vi.) No agglutination of *B. Typhosus*, but of *Paratyphosus* in high dilution.

3. Partial reaction with *B. Typhosus*. By this is meant a loss of motility of the organism, with possible attempts at agglutination; or a small degree of clumping but a few bacilli still remaining motile.

    (vii.) Partial reaction with *B. Typhosus* only (*Paratyphosus* being unaffected).

    (viii.) Partial reaction with *B. Typhosus* together with agglutination of *B. Paratyphosus* in low dilution.

    (ix.) Partial reaction with *B. Typhosus* together with agglutination of *B. Paratyphosus* in high dilution.

4. Reversed agglutination reaction; that is, more marked or earlier appearance of agglutination in the higher dilutions than in the lower.
5. Positive reactions in apparently healthy subjects.

Among the 1,500 sera examinations on which this study has been founded, there have been several examples of all the above; but, to describe them all would fill a book, so I propose to narrate one example only of each case in which the results are liable to misinterpretation or more than one interpretation, in order to show the process of reasoning in arriving at what, in my opinion, is the correct solution of the problem.

In every instance a control is put up to ensure that the organism is evenly distributed (*i.e.*, that no clumps are present) and that the individual bacilli exhibit well-marked motility.

1. *Positive Reaction with* Bacillus Typhosus.

(*i.*) *Agglutination of* B. Typhosus *only with dilutions of the serum up to* 1 :100 *at least.*

Here there may be one of two solutions : either the patient is suffering from an attack of typhoid fever or has done so in the past. The first of these two alternatives calls for no further remark, for the ordinary case fulfils this requirement, unless it be to say that I have found on several occasions that where the reaction is marked in high dilution and early in the disease, the course of the illness is generally a mild one. In a case of average severity the reaction is usually quite distinct by about the seventh day of the fever. When it is given early, such as on the third or fourth day, I have noticed that the case is usually milder, and, not infrequently, the temperature reaches normal sometime about the middle or end of the third week. I am well aware of the difficulty which there is often in determining the date of onset of the fever, but the following is a good example.

A. R., aged 16 years, was the third in one family to be attacked; he began to complain of feeling out of sorts on December 12th, 1911; the doctor was attending at the house, and on taking his temperature found it 99·6° F., the next morning 99°, and the following evening 100·2° F. The third morning it was 101°, and a specimen of the blood was taken and sent to the laboratory. A good reaction was given within the time limits stated above. The rash was first seen in the afternoon of the third day later, so that the blood was examined, one may fairly say, on the third or at latest fourth day of the fever. The temperature in this patient never rose above 102·4°, and only reached this on two occasions, and touched normal on the 16th day; he made excellent progress and an uninterrupted convalescence.

In contrast to this the outlook is more grave when the reaction appears late. There have been many instances of this; the following is a brief description of one of them.

S. L., aged 22 years, had been ill for at least six days with headache, fever, and abdominal pain. There was abdominal tenderness and the spleen was enlarged when the patient was first examined on May 12, 1911. Clinically, it looked a typical case of enteric fever, but the Widal reaction was quite negative (except for some loss of motility). Five days later a note was made to the effect that the patient was very ill, delirious, &c., and the blood was again examined. Within the time limits laid down it was still negative, but small clumps were seen in the 1 :30 dilution in 20 minutes, in the 1 :50 in 40 minutes, while the 1 :100 was quite negative.

Four days later (*i.e.*, at least the 16th day of illness) the blood was again tested, and this time gave a well-marked positive reaction. His illness was very prolonged, the temperature did not reach normal until the 35th day, but he had no relapse.

Occasionally it is even longer still before the reaction declares itself. Thus, a patient, E. N., was admitted to hospital on February 28th, 1912, " clinically severe enteric." On 29th the blood was examined but gave negative results. The history was unreliable, so that it was thought that the patient might be in an early stage of the disease. A week later the blood was again taken and examined, and this time the reaction was partial only; merely a loss of motility in the 1 :30 and 1 :50 dilutions, no agglutination (see later under 3, Partial reactions), and not even loss of motility in the 1 :100. Again, a week later, the blood was examined, and this time the 1 :30 was positive, while the 1 :50 and 1 :100 showed only loss of motility. In short, it was not till the 33rd day after admission, when the temperature had dropped to normal and the patient was convalescing from a very acute attack, that a definite positive agglutination was obtained in high dilutions.

The second alternative, namely, that the subject has suffered from an attack in the past, is cleared up by the history. As a very marked instance of this the following case may be cited : C. J., a man of 20 years of age, was examined when a routine testing of the sera of all the constables at a police depôt was carried out in August, 1911. He was in good health and did not remember having any serious illness since he was 12 years old. His blood gave a very definite agglutination, the details of which were—

1 :30	positive	in 15 minutes.
1 :50	,,	,, 20 ,,
1 :100	,,	,, 35 ,,
1 :1000	,,	within an hour.

Further investigation was made of this man's excreta in order to find out whether he was a "carrier," but with negative results on each occasion. He was not sickening for the disease because he still remains well (September, 1912).

Whether agglutination is to be regarded definitely as an immunity reaction (a question, I believe, still *sub judice*) or not, I nevertheless think that the degree of agglutination may be regarded as an "indication of immunity" or power of resistance to a certain extent, and that this man would, in the first instance, not be a ready subject for attack by the *Bacillus Typhosus*, or, secondly, if he did contract the disease, the illness would probably run a mild course.

(*ii.*) *Agglutination of* B. Typhosus *together with agglutination of* B. Paratyphosus *in low dilution* (1 :30).

As a rule this latter is of no great significance, being merely a "group-agglutinin reaction." This has been repeatedly tested and proved by Castellani's method and found to be correct. In a few cases, however, double infection was present, and in such the disease was usually prolonged, and when the blood was again examined, the agglutination of the *B. Paratyphosus* was found to occur in considerably higher dilution. So that for prognosis either the test for mixed infection must be carried out or another examination must be made later on, and before an opinion is given the two results must be considered together, having regard especially to the persistence of the *Typhosus* reaction and the increasing *Paratyphosus* reaction.

As an example of the former (group reaction):

E. W., male, aged 25 years, was taken ill on May 6th (or thereabouts); the rash appeared on the 12th, and a Widal test on the 15th (*i.e.*, the 9th day of disease) gave positive reaction with *B. Typhosus* 1 :30 in 15 minutes, 1 :50 in 25 minutes, 1 :100 in 50 minutes, and with *B. Paratyphosus* 1 :30 in 25 minutes (thus, beyond the time limit somewhat). This was shown to be a "group" reaction, the temperature reached normal on the 23rd day, and all went well.

As a good example of the second (mixed infection):—

C. P., aged 19 years, with a history of having been ill for six days; note when first seen stated "severe enteric clinically." This patient's serum gave on the sixth day of illness: with *B. Typhosus*, agglutination 1 :30 in 20 minutes, 1 :50 in 40 minutes (a little delayed, therefore, beyond the time limits laid down, and N.B. "clinically severe," see later, delayed reactions), and 1 :100 in just over the hour. With *B. Paratyphosus* a positive 1 :30 in 15 minutes. The dual nature of the infection was shown by Castellani's method. Five days later a second examination of the blood showed: with *B. Typhosus*, positive 1 :30 in 15 minutes, 1 :50 in 30 minutes, and 1 :100 in 50 minutes; and with *B. Paratyphosus*, positive 1 :30 in 15 minutes, 1 :50 in 25 minutes, and 1 :100 in 40 minutes.

The patient passed through a severe attack, the fever lasting for five weeks, but without any relapse, and he finally made a good recovery.

(*iii.*) *Agglutination of* B. Typhosus *together with agglutination of* B. Paratyphosus *in high dilution* (1 :100 *or more*).

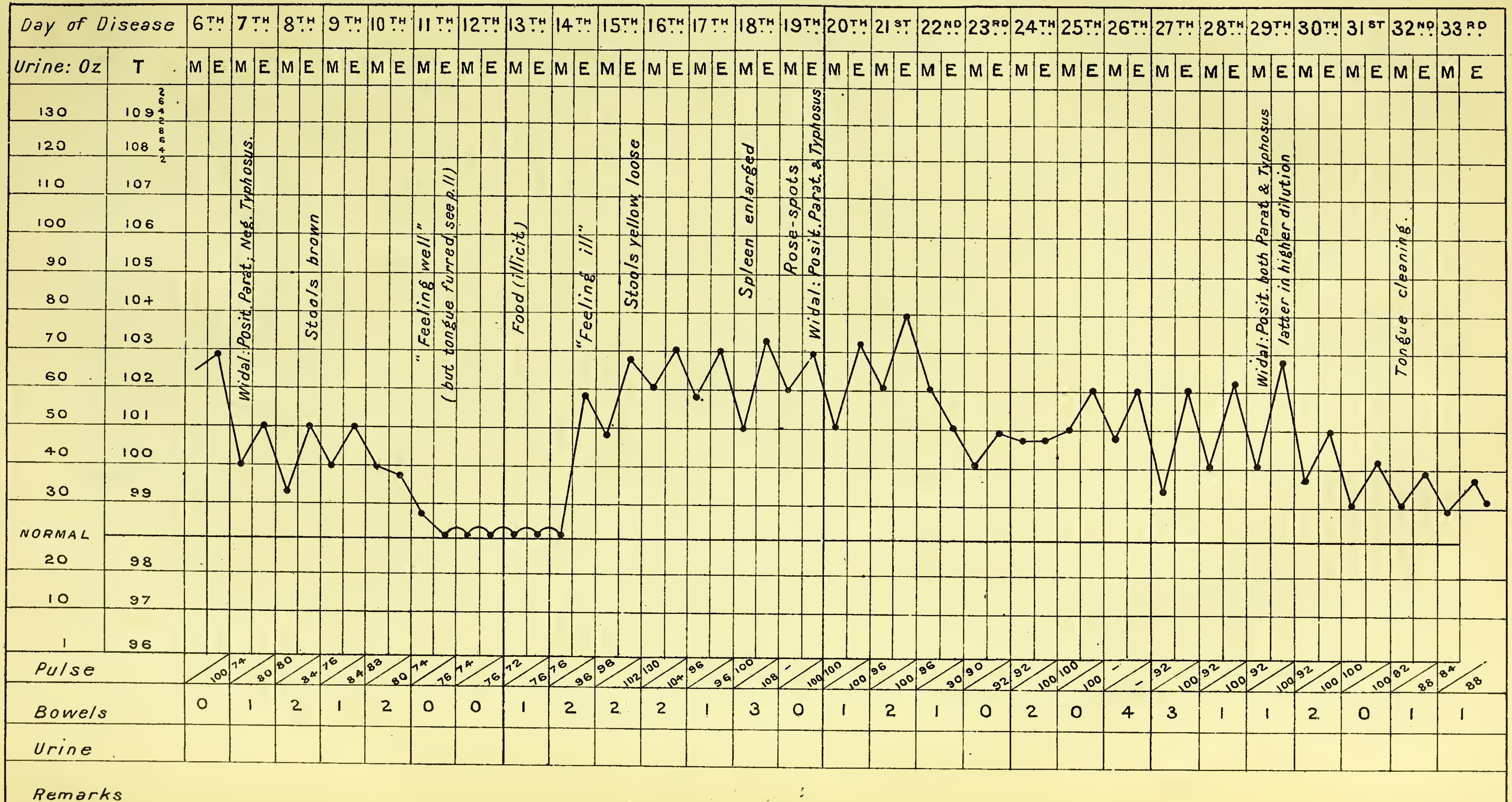
This has to some extent been covered in the last paragraph. I have occasionally seen a positive reaction with *B. Paratyphosus* in as high a dilution as 1 :50 due merely to group agglutinins, but if higher than that the condition has always been a double infection, and in such the illness is usually a long one, but, so far as my experience goes, apart from the debilitating effects of the prolonged fever and the consequent tedious convalescence, the dangers are not greater than with ordinary uncomplicated typhoid.

Lastly, in this connection must be mentioned cases where there is agglutination of *Typhosus* in low dilution with that of *Paratyphosus* in higher. This may be a case of *Paratyphosus* infection with a group reaction with *B. Typhosus*, but in my experience this has been rare. In almost every instance the interpretation is a double infection, and, as time goes on, the former declares itself, bacteriologically by the increasing dilution of the serum in which agglutination takes place, and clinically by the general condition of the patient.

An important point in this connection is that the patient is not at first very ill and the temperature often falls at the end of 10 or 12 days, and there is a clamorous desire for food. Now, if the tongue be clean, feeding may be begun and

CHART I.

Dr. Rogers.
NAME OF PATIENT AND AGE. A. R.
WARD AND BED.
DISEASE. Enteric Fever (Paratyphoid followed by Typhoid.)
RESULT. Recovery.
DAY OF MONTH. May 27th. 1912.



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cautiously proceeded with, and the patient makes, as a rule, good progress. If, however, the tongue be not clean, no matter how well the patient appears to be, feeding with more solid food is often associated with grave consequences; a relapse is almost certain, and this relapse is not a mere repetition of the illness which has just passed, but runs the course of a typical attack of typhoid fever with the "staircase" rise of temperature, abdominal pain, splenic enlargement, and the appearance of rose spots in many cases (these may not have been found during the previous shorter fever). I have several times been struck with this apparently paratyphoid relapse taking on the characters of a typical attack of typhoid fever, and is a point in support of the view that *Paratyphosus* agglutination in high dilution associated with *Typhosus* agglutination in low not infrequently means a double infection, much more often, in fact, than a high *Typhosus* reaction associated with low *Paratyphosus*, which I have found in the majority of instances means typhoid fever in which the blood is giving also a group agglutinin reaction with *Paratyphosus*.

The following is a typical example of either a double infection, or an attack of paratyphoid fever in its relapse showing the characters of true typhoid fever.

The patient was the wife of a medical man. She suffered with an ill-defined fever for six days, varying between 99° F. and 101° F. On that day a chart of the temperature was begun. On the morning of the sixth day it was 101°, in the evening 102·8°. The patient felt very fairly well in spite of the continued rise of temperature. The blood was taken; no malarial parasites were found, but a well-marked agglutination occurred with *B. Paratyphosus*, while with *B. Typhosus* there was merely loss of motility, with possibly some slight attempts at clumping in 1 :30 dilution only. In accordance with the foregoing remarks this latter reaction might be a group reaction, or an early stage of a double infection. The patient, however, as the history states, felt comparatively well, a point against my experience with double infection. In the attached Chart (I.) it will be seen that the fever ran a ten-day course, at the end of which time the patient expressed herself as feeling "quite well" and clamoured for solid food.

The tongue, however, was still considerably furred, so this request was not granted. She was not sufficiently ill to need a trained nurse, and while she was left alone for a short period she got up out of bed and ate some bread and butter and a little fruit. The following day she complained of feeling worse, and the temperature began to rise again. In a few days all the symptoms of a typical typhoid fever attack made their appearance. There was more general malaise, more headache, the spleen could be felt (whereas in the previous attack it could not), and in three days more rose spots appeared (these also had been absent in the preceding fever). The blood was again taken on the seventh day of the fresh fever, and this time, in addition to the former *Paratyphosus* agglutination, there was a well-marked reaction with *Typhosus* also. As will be readily seen on looking at the attached chart of this case, the relapse (if such a name can be given to the fresh febrile attack) was not a repetition of the previous short fever of ten days, but lasted for three weeks, and was, in fact, a typical attack of typhoid fever.

2. *Negative reaction with* Bacillus Typhosus.

(*i.*) *No agglutination of either* B. Typhosus *or* Paratyphosus.

In the absence of any history there are three possible interpretations of this :

(*a*) That the patient is not suffering from enteric fever, either typhoid or paratyphoid.

(*b*) That the disease, though present, is in an early stage, the agglutinins not having as yet been formed. There is no need to cite any examples of this, as they are frequent in the experience of all. Blood specimens are often sent up to the laboratory with the statement that the patient has been having fever for three (or it may be four or five) days, and appears clinically to be suffering from typhoid fever; nevertheless, the reaction is totally negative; at most there may be some loss of motility, but there is no agglutination. Under these circumstances, another specimen is asked for, to be taken after the seventh day, when, as a rule, the reaction is well marked.

(*c*) That the case is one of more than average severity, and that the systematic reaction is poor and agglutinins are not formed until late.

Two cases in hospital recently have had their sera tested every three or four days, and one of these did not give a positive reaction till the 32nd day of the disease, and the other on the 29th day. Both of these were exceptionally severe; the temperature kept high, there was a state of coma-vigil for some days; in fact, clinically there was no doubt in either case all through the illness that the disease was typhoid.

In (*b*) and (*c*) the interpretation is usually easy if a brief history is sent up at the same time as the specimen, and as regards prognosis one may usually say that if the case is "clinically typhoid" (I do not mean merely that the patient is in what is called a "typhoid state," which may, of course arise in many affections not "clinically typhoid"), but no agglutination is obtained by the 10th day, the case is likely to be severe and prolonged.

Not uncommonly a hæmorrhage in these cases will within a few hours (provided it is not fatal) be followed by a marked rise in the agglutinating power of the serum. I am inclined to think that in some of such cases benefit would result if nature were to be forestalled and a small quantity of blood were withdrawn by venesection, and the agglutinating power of the serum be thus raised; however, though an interesting point, this is beyond the scope of the present article.

(*ii.*) *No agglutination of* B. Typhosus, *but agglutination of* B. Paratyphosus *in low dilution* (1 :30).

With the proviso that the day of disease is such that the reaction should be given, a question which has just been dealt with, the interpretation of this condition is usually that the fever will run a mild course, and, moreover, is very probably neither typhoid nor paratyphoid. Many normal sera will agglutinate *B. Paratyphosus* in low dilution, even in the absence of any evidence of a previous attack of typhoid (a severe paratyphoid would probably be thus described by the patient; the term "typhoid" here does not necessarily mean that the illness was due to a *B. Typhosus* infection, and this is one of the reasons for thinking that it would be better to include them both under the term "enteric fever," and, where bacterial examination had revealed the nature of the causative organism, that might be with advantage mentioned on the notification certificate).

In other cases, in patients with nothing more than a slight intestinal upset, described by them perhaps as a "liver attack," I have found that *Paratyphosus* agglutination in low dilution may sometimes be obtained; whether this is due to some coli infection and the reaction is of the nature of a group agglutination, I cannot say. This, however, is by no means always the case, as the following will show :—

A woman, U. McI., was admitted to hospital on April 13th, 1912, complaining of diarrhœa and abdominal pain, which had persisted for seven days. The temperature was found to be 102°. Her serum gave a positive reaction with *B. Paratyphosus* in 1 :30 dilution, and it was thought here was an instance of "enteritis," with a rise of temperature due to toxic absorption possibly, but the patient seemed too ill for this. The ordinary treatment, anyway, was ineffectual, and the temperature did not reach normal till the 19th day after admission.

On the 14th day of disease, agglutination of *B. Paratyphosus* occurred in the 1 :30 and 1 :50 dilutions, and a partial reaction took place in the 1 :100; also there was a delayed reaction with *B. Typhosus* (1 :30 in 25 minutes). Two days after the temperature touched normal it again rose, and the patient went through a regular attack of typhoid fever, and on the 35th day of illness the reaction was again tried, when distinct agglutination of both *B. Typhosus* and *Paratyphosus* occurred.

As a rule, where the low *Paratyphosus* reaction only is shown, the patient is not so seriously ill as this one was even at the early stage at which she came into hospital; on the contrary, the subject (he is hardly ill enough to be designated "patient") is usually up and about, with possibly a little rise of temperature, whereas the one whose history is briefly related above had a temperature of 102° F., and a history of seven days' intestinal upset.

(*iii.*) *No agglutination of* B. Typhosus, *but agglutination of* B. Paratyphosus *in high dilution* (1 :100 *at least*).

This usually means an attack of paratyphoid fever, and the more readily the reaction is given, I find, the shorter, as a rule, is the attack. It is frequently found

in Jamaica in what is known popularly as the seven-day fever, or, perhaps, more commonly still, the ten-day fever.

A good example of this is the following :—

C. G., female, came to hospital on May 4th with a history of six days' illness. Her serum agglutinated *B. Paratyphosus* in 1 :30 dilution in 20 minutes (a little over the time limit laid down); during the next three days the temperature was not quite so high, but the patient seemed ill, and the medical officer in charge thought she was "going in for enteric," so her blood was again examined, when it was found to give a marked positive reaction with *B. Paratyphosus*, 1 :30 in 10 minutes, 1 :50 in 20 minutes, and 1 :100 in 35 minutes. This being such a strong reaction and well within the time limits, and as there was no reaction at all with the *B. Typhosus*, the prognosis given was a favourable one, that in spite of the appearances clinically, the strong reaction and the falling temperature pointed to a speedy termination, and that if the tongue cleaned food might be given in a day or so after the temperature reached normal, if the patient asked for it. (It is as well not to press it in these cases if the patient does not ask). True enough the temperature reached normal next day (10th), the tongue cleaned up by 24-36 hours later, more solid feeding was started, and the patient, who had gone through a sharp bout of 10 days' fever, made a rapid recovery.

There have been large numbers of such cases, but it is needless to give details of more; the above is a typical instance.

(3.) *Partial reaction with* Bacillus Typhosus.

By the term "partial reaction" is meant that within the time limits laid down there is a loss of motility only, either no agglutination at all, or merely a faint attempt at it; there may be, perhaps, a few small clumps of three or four bacilli, but the majority are lying single and motionless. In many of these cases, if the reaction be watched for a longer time, agglutination may be seen to take place later.

(*i.*) *Partial reaction with* B. Typhosus *only* (*no action with* B. Paratyphosus).

This occurs :—

(*a*) At an early stage of the illness, often up to the fifth or sixth day, the specific agglutinins not as yet having been developed. This is the most frequent solution, and the history and clinical condition usually suffice to prove it; at all events, examination of the blood three or four days later will generally reveal a definite positive reaction. There is no need to quote cases in support of this, for everyone who carries out the Widal test over a series of cases must have met with such frequently.

(*b*) When the attack is a severe one. In such instances the reaction is only partial in spite of the lapse of the time within which it should appear, such as the seventh or tenth day, or even later.

The following is a typical example :—

K., a coolie, was admitted to hospital on May 4th, obviously very ill, "clinically severe enteric" (according to the note), with a history of at least seven days' fever, and the temperature on admission was 104° F. He was apathetic, dull, and heavy, and looked more like a case at the end of the second week, with furred tongue, tremor of lips, enlarged spleen, tender abdomen, and so forth. His serum, examined on May 6th, gave loss of motility only with *B. Typhosus*, no agglutination at all; five days later, at a second examination, there was distinct agglutination in low dilutions (1 :30 and 1 :50), but delayed, the 1 :30 to 20 minutes, the 1 :50 to 40 minutes, and although the fever remained high, his general condition did not appear to be any worse than at the time of his admission to hospital. It was not until the 21st day after coming to hospital (therefore at least the 28th day of disease), when the temperature was dropping and the patient seemed to be making headway, that a definite positive agglutination reaction in higher dilutions was obtained.

Sometimes the conditions named under (*a*) and (*b*) may combine as causes of a partial reaction, as in the following :—

T. N., admitted to hospital, April 22nd, with a history of "four days' illness and fever;" the probability was that the condition had been of longer duration than this. The note made by the Medical Officer on duty was "looks like enteric."

However, when the blood was examined on the following day there was merely loss of motility of *B. Typhosus* only in low dilution, no sign of any agglutination.

This, according to the ideas stated above, might be due to the early stage, presuming the history was correct, or to a severe attack with feeble agglutin formation, or to both combined. It was not until a week later, that is, at the very earliest the 12th day of fever, was the reaction positive, but then it was most distinct, the details being agglutination of the bacilli with the 1 :30 dilution in 15 minutes, with 1 :50 in 25 minutes, with 1 :100 in 50 minutes, and 1 :500 in 75 minutes.

(*c*) Thirdly, the partial reaction may be merely an exhibition of the natural resistance to infective organisms and may be given by the sera of healthy subjects in moderate dilutions, though rarely, it is true, so high with *Typhosus* as 1 :30 in a quarter of an hour.

(*d*) Lastly, it may be a residual sign of an old attack. Thus, in December. 1911, and January, 1912, all the nurses employed at the Public Hospital were examined. One of them gave a partial reaction, and, on being questioned, stated that she had had an attack of enteric fever six months before she came to the hospital for duty. She told me that the medical attendant at the time had sent a specimen of her blood to the laboratory for examination, so that I was able to verify her statement by referring back to the records of the laboratory work. I discovered that the blood had given a marked positive, agglutinating in a 1 :100 dilution in 45 minutes.

Sometimes the reaction lasts much longer, for another nurse, whose blood was examined at the same time gave a positive 1 :30, but only partial 1 :50. She had been at the hospital for years, and the records there showed that she had passed through a severe attack of typhoid fever three years previously.

(*ii.*) *Partial Reaction with* Bacillus Typhosus, *together with a Positive reaction with* B. Paratyphosus *in low dilution.*

The interpretation of this differs according to whether the partial *Typhosus* reaction occurs with low dilution only or with higher dilutions also.

(*a*) If in low dilution of the serum only (1 :30), it is usually an attempt at a "group reaction," and the case turns out to be one of paratyphoid fever, analogous to a positive *Typhosus* agglutination in conjunction with a *Paratyphosus* in low dilution, and the disease is usually quite mild.

(*b*) If in high dilution, in spite of the Typhosus reaction being only partial in all the dilutions while the *Paratyphosus* gives a positive agglutination definitely in low dilution, it will be seen as time goes on that the latter is more of the nature of a group reaction, while the former is the attempt at specific reaction and the patient is often very ill (see under Partial Reaction of *B. Typhosus* only). That this interpretation is the correct one is borne out by the fact that as time progresses, if the blood be examined at short intervals of two days or so, it will be found that the "group" reaction (as I have called the *Paratyphosus* agglutination in these cases) remains stationary at 1 :30 or thereabouts, while the *Typhosus* reaction develops in increasing dilution. Thus :—

C. H., admitted to hospital March 27th, with a history of seven days' fever (at least) and apparently "clinically severe typhoid fever" (according to the note made). The blood gave a partial *Typhosus* reaction in all three dilutions, 1 :30, 1 :50, and 1 :100, and a positive agglutination of *B. Paratyphosus* in 1 :30. On March 29th, the results of a second examination of the blood were agglutination of the *B. Typhosus* 1 :30, but still only partial in 1 :50 and 1 :100, while the *Paratyphosus* reaction remained as before.

There is no need to trace the daily changes in the blood reaction, which may be briefly stated thus : The *Typhosus* reaction steadily increased, while the *Paratyphosus* one remained stationary till, on April 11th, the results were :—

Agglutination of	*B. Typhosus*	1 :30	serum	in	10	minutes.
,,	,,	1 :50	,,		20	,,
,,	,,	1 :100	,,		40	,,
,,	*Paratyphosus*	1 :30	,,		15	,,

as in the first instance, and the attack turned out, as was expected, to be a severe one.

(*iii.*) *Partial reaction with* B. Typhosus *combined with definite agglutination of* B. Paratyphosus *in high dilution.*

The interpretation of this is in part analagous to the last; that is, if the partial reaction of *B. Typhosus* occurs in low dilution only, the case is probably one of

paratyphoid fever with a group *Typhosus* reaction (or rather attempt at it); if, however, the reaction is partial in high dilutions also, then the case will almost certainly turn out to be one of double infection. I have noted this in several instances; 32 in my series of 1,500.

The following will suffice to illustrate my point:—

B. R., admitted to hospital May 8th, "clinically typhoid." His blood when examined on the 10th gave:—

Agglutination of *Paratyphosus*	1:30	serum in	10 minutes.
,, ,,	1:50	,,	20 ,,
,, ,,	1:100	,,	50 ,,

With *B. Typhosus* the reaction was partial in all dilutions, and there were feeble attempts at agglutination in the lowest (1:30) dilution, *i.e.*, there were a few small clumps of three or four bacilli.

Four days later, in addition to the *Paratyphosus* reaction, *B. Typhosus* was definitely agglutinated in the 1:30 dilution of the serum, and small clumps were forming in the 1:50, but somewhat delayed beyond the usually employed time limit. Castellani's method of removal of group agglutinins for diagnosis between simple infection with group reaction on the one hand and mixed infection on the other was carried out, and the latter definitely shown to be the case here; moreover, the bacilli were isolated from the stools on the third day of the disease.

The significance of these partial reactions reveals one of the greatest defects in the otherwise extremely useful "stock agglutometers" sent out by various firms for the use of practitioners in private practice, because, the bacilli being already killed, none of these earlier stages prior to agglutination, namely, the primary increased motility, the subsequent diminution, and final loss can be observed.

4. *Reversed Agglutination Reaction.*

By this term is meant that clumping of the bacilli is seen to take place with a serum in high dilution but not in low, or, if it occurs in the latter, it does so to a less degree or is delayed.

Several explanations have been advanced to account for this phenomenon, of which the three following are, I believe, those most widely held—:

(1) That "agglutinoids" are present, which have a greater affinity for the bacilli than the normal agglutinins have, and that the former, therefore, combine with the agglutinable substance of the bacilli, and so prevent the normal agglutinin action. The agglutinins are believed to be more abundant, however, and if the organisms are in large quantity, the agglutinoids are used up and the remaining bacilli are then clumped by the agglutinins.

(2) That the agglutinoids being much less abundant than the agglutinins, the greater dilution of the serum reduces the former to a relative absence, and the agglutinins are then able to unite with the bacilli.

(3) Held by those who disbelieve in the existence of the agglutinoids:

That in low dilutions of the serum a certain degree of solution of the bacilli takes place, and bacilli so acted upon will not clump; in higher dilutions this bacteriolysis does not occur and agglutination proceeds as usual.

Though these hypotheses, for they are little more, would explain the failure of agglutination, it does not appear to me that any of them account for the fact that time is a factor in the case, for I have found that in some instances the 1:100 dilution will clump within half an hour, while the 1:30 shows only loss of motility or very slight indication of clumping in an hour, while, again, the 1:50 is intermediate, showing clumps smaller than those in the 1:100, but larger and more definite than those in the 1:30; yet, if the hanging-drop be watched for a longer period, the 1:50 may show complete clumping in perhaps an hour and the 1:30 in $1\frac{1}{2}$-2 hours, but even in these cases though the agglutination is complete (in that no motile bacilli are seen and practically no isolated organisms) nevertheless the clumps are smaller than those in the 1:100 dilution. The case thus differs from a mere delayed reaction.

The point which I wish to emphasise, however, is the fact that in nearly every case in which this phenomenon has been evident in my series (19 times in the 1,500 consecutive examinations), there are some anomalous symptoms met with. Fourteen of the 19 were children; all these 14 were under the age of 12 years, and

five of them under four, and of the remaining five cases only one was over the age of 18 years.

It would be difficult without quoting each case in detail to state exactly in what respects the anomalies presented themselves, but briefly it may be said that the medical man sending up the specimen on nearly all the occasions (I have noted it in 16) stated "the case does not look to me like typhoid fever" (or some such words); either the temperature was irregular, the patient was apparently very slightly upset constitutionally (in most cases), or the disease started with a convulsion, or in some way or another the course was peculiar; often the blood was sent up merely because the temperature continued to be slightly elevated for a prolonged period and would not yield to quinine, or because "no cause can be found to account for the fever."

I attach hereto a chart (Chart II.) of one case in which this reversed reaction was given; as will be seen, it is anything but typical of a typhoid fever temperature, and the history, as far as I could obtain it, was as follows :—

Ralph Brown, aged 13 years. The boy had been ailing for a few days, and on May 19th had a severe shivering fit, "lasting about an hour," and seemed to lose consciousness for a time. There was no repetition of the fit, but the patient continued to be ill, and vomited on the 20th. He was brought to hospital on the 21st, when his temperature was found to be 102° F. Quinine was given, but was ineffectual, and on the 27th (ninth day of illness) the blood was sent to the laboratory, and it was found to give the "reversed reaction" noted above; there was no reaction at all with *B. Paratyphosus*. There was very little, if any, abdominal pain, but some degree of distension, and the spleen could be felt, but was not tender; no spots were visible. He appeared at this date to be only slightly ill, and there was nothing in his general condition to suggest enteric fever.

The temperature just touched normal on the 1st of June, or 14th day of disease, but did not remain there. He appeared to be making fair progress, but no increase of diet had been allowed, when on June 12th (25th day of disease) the temperature again rose suddenly to 103° F., and three days later to 105°, without anything definite being discovered to account for it; the bowels were acting regularly. The fever did not really subside until the middle of the seventh week.

The history is meagre, but apparently there was nothing of importance to note except negative points; there were no complications, and nothing except the continuous fever and the bacteriological examination to lead the medical attendant to regard the case as one of typhoid.

This patient's serum gave quite negative results with *B. Paratyphosus*, as already stated; in some, however, a group reaction is given, *but this reaction does not show in a reversed way*. If a series of hanging-drops be put up with a serum which gives this reversed reaction with *B. Typhosus*, and also the group *Paratyphosus* reaction, in increasing dilutions with the latter—1 : 10, 1 : 20, 1 : 30, 1 : 40, 1 : 50—the first is most marked, the others diminishing till the higher, 1 : 40 and 1 : 50, are negative, in spite of the fact that the agglutination with *B. Typhosus* is more marked in the 1 : 100 than in the 1 : 50, and in the 1 : 50 than in the 1 : 30. In other words, I have never found the group reaction to be reversed.

Lastly, in connection with this question, one more fact may be deemed worthy of mention. If a further series of still higher dilutions be made with a serum which has shown the reversed reaction up to, say, 1 : 100, at a certain point the degree of agglutination again begins to wane. Thus, in one case, in which the condition under consideration was very marked, the 1 : 30 dilution showed no agglutination at all, the 1 : 50 was partial, the 1 : 100 showed marked clumping, as did also a 1 : 200. A 1 : 500 exhibited less than the last two (1 : 100 and 1 : 200), while a dilution of 1 : 1,000 showed results practically identical with those of the 1 : 50, *i.e.*, loss of motility, with here and there attempts at agglutination with small clumps of three or four bacilli.

I fail to see how this phenomenon can be accounted for by either of the three hypotheses stated at the beginning of this section.

5. *Positive Reactions in Healthy Subjects.*

Positive reactions may be given in apparently healthy subjects in three classes of cases :—

i. As a residual reaction after a previous attack, as in the cases quoted above. (Section 1.)

CHART II

Dr.
NAME OF PATIENT AND AGE. R. B. 13 Years.
WARD AND BED.
DISEASE. Typhoid Fever.
RESULT.

ii. In a person who is "carrying" the bacillus. If he has had a definite attack of typhoid fever and subsequently becomes a carrier, this would be included under the last, but occasionally a carrier is found without any history of a previous attack being obtained or of anything which can reasonably be construed as such.

iii. In persons who are apparently in excellent health, who are not excreting the bacilli, and who, as subsequent events prove, are not in the incubation stage of enteric fever.

Accurate histories amongst a native population are always matters of difficulty, but excluding those who give an account of fever (often called "malaria") extending over several days, which might possibly have been enteric, I have examined the blood from 228 subjects and have found either with *B. Typhosus* or *B. Paratyphosus* a positive result in 37, or 16·6 per cent.; or, if quite low dilutions be also taken into consideration (such as 1 : 10 and 1 : 20), as many as 57 (25 per cent.).

At the General Penitentiary in Kingston no man is permitted to be employed in the kitchens unless his blood has first been tested by the Widal reaction, and it is an astonishing fact that out of 84 so examined 11, or 13 per cent., gave a positive reaction with *B. Typhosus,* while 16, or 19 per cent., reacted positively with *B. Paratyphosus;* omitting those which gave reactions in low dilution only, 14 yielded positive results, *i.e.,* 16·6 per cent., of which 6, or 7·1 per cent., were with *B. Typhosus* and eight, or 9·5 per cent., with *B. Paratyphosus.*

Any whose blood gave a positive was then further examined in order to ascertain whether he was excreting the bacilli; the above figures exclude all carriers.

At other institutions where examinations were undertaken of the blood of the "apparently healthy":—

At the police depôt, Spanish Town, out of 47 subjects, four gave a positive reaction with each bacillus, *i.e.,* 8·9 per cent. with *B. Typhosus* and the same with *B. Paratyphosus,* a total of 17·8 per cent.

Many, both of those at the depôt and of those at the penitentiary, had very likely suffered at some time from the disease, but particularly at the latter the history was undoubtedly in many cases unreliable.

Among nurses on duty at the Public General Hospital, out of 51 whose blood was examined five (or 9·8 per cent.) gave a positive with *B. Typhosus,* and three (or 5·9 per cent.) with *B. Paratyphosus.*

Apart from these, 39 sera were examined from those who at the time of investigation were in good health, but who had suffered from "prolonged fever," many probably enteric, during the previous five years, but none less than one year earlier. Of these, 20, or 51 per cent., gave a positive reaction with *B. Typhosus,* and six, or 15·4 per cent., with *B. Paratyphosus.*

It would obviously give an entirely erroneous impression if these latter were included amongst the "apparently healthy" who gave no history of any previous prolonged illness. It is interesting also to note that only three of those whose sera were examined and which gave a positive reaction were definite "contacts" of recent cases.

Finally, in this connection, one case is particularly worthy of note :—

A child of nine months suffered from an attack of typhoid fever, proved by isolation of the bacillus. The question next arose as to the method by which the child could have become infected. The little patient's mother was the nurse in charge of the enteric ward at a general hospital in the island, and it was thought that she might possibly have taken some milk or other food from the ward home to the child. A specimen of the mother's blood was asked for, and it was found to give a very marked agglutination of *B. Typhosus* in high dilution.

The nurse was perfectly certain that she had never suffered from typhoid fever, or, in fact, prolonged fever of any kind; she had always been healthy, and "never remembered being ill in her life" (to quote her own words). The next step was the examination of her stools and urine; the *Bacillus Typhosus* was isolated from the latter; in short, this nurse was definitely a "carrier," though never having herself suffered from the disease, and she seems without doubt to have conveyed the disease to her child.

It would have been interesting to examine her milk (for she was suckling the baby) in order to see whether the bacillus could be isolated from it, but, apart from the difficulty of discovering the organism, the inference that this was the mode of infection in this instance would not hold good, even if it were found, when

the more ready method of transference to the outside of the breast by the fingers could not be excluded.

II. Plague.

Another matter of interest, which happily did not become serious, is that of plague. So far as the facts apply to Jamaica they may be briefly stated as follows :—

At the beginning of July word was received of the outbreak of plague in Havana, at which place a Jamaican vessel had stayed shortly before, and had then returned and made a tour of the island. On July 12th, at a meeting of the Quarantine Board, the decision was arrived at of having this ship thoroughly disinfected, and all rats caught were brought to the laboratory. Sixty-seven were found, and on dissection nine of these were suspicious; smears and cultures were made of the various organs, &c., of these nine. Two yielded very typical colonies; subsidiary tests were made, which need not be detailed here, except to say that cutaneous inoculation into guinea-pigs caused the death of these animals, and from them again the bacillus was recovered.

The notification was fortunately received shortly before the ship was starting to make another tour of the island; "fortunate" because these two rats would undoubtedly have infected others, and thus might have spread the disease at each port stopped at.

Since that time rewards have been given for rats caught on the wharves and elsewhere, and 853 of these have been examined at the laboratory, but from none of them has the bacillus been isolated.

III.

The important question of infection of coolies and natives with anchylostome is being dealt with by a special investigation which is being held in various parts of the island, so it will suffice for me to say that 253 specimens of excreta have been sent up to the laboratory, and of this number 191 have shown the ova of anchylostome usually mixed with large numbers of *Ascaris Lumbricoides* and *Trichocephalus Dispar*. Thus, 75·5 per cent. of those sent up have been infected with anchylostomiasis. It was formerly believed that this condition was largely limited to, or at all events was much more common in, the coolies, but, as a matter of fact, judging from the specimens sent to the laboratory, the native is very often infected also, though the *Ascaris* is more common in him. But in 162 specimens from East Indians, the ova were found in all but 17, that is, in 89·5 per cent., while among the remainder (91) the ova were found in 56, or 61·5 per cent.

IV. Vomiting Sickness.*

This matter, of great importance to Jamaica in that it is responsible for a very large number of deaths every year, mainly in the colder months, has happily been solved, if not completely, at least in part, during the past month.

The disease is very uncommon except in certain districts of the island and in the winter months, December to March; though from one or two circumstances I have been led to the belief that sporadic cases occurred at other times, the disease becoming epidemic in certain parts during these colder months.

This inference was founded on the fact that in April, May, and June of this year, three cases were admitted to hospital (19th April, 9th May, and 4th June), two of them showing typical symptoms of this so-called vomiting sickness. In fact, the note sent up with the patient in one of the cases stated that had the case occurred during the winter months it would have been unhesitatingly diagnosed vomiting sickness; the same was told me verbally in the second case. It is a firm belief (and a belief which, I think, has had something to do with retarding the discovery of the nature and cause of the condition) amongst the majority of practitioners in Jamaica that the disease is restricted to the months, December-March, and they are, therefore, averse to making this diagnosis during other seasons.

The cerebro-spinal fluid drawn from each of these three patients revealed the presence of the diplococcus of Weichselbaum, and I was able to cultivate the organism from them all. This fact made such an impression upon me that I requested that some vials of anti-meningococcic serum might be ordered for trial during the next cold weather in cases of vomiting sickness. This was done at the end of August, but the serum has, of course, not yet arrived.

The second opportunity for testing my hypothesis arose on the 4th September, when a sudden outbreak of this mysterious affection took place in Kingston itself

* See also Appendix VII.

Briefly, the history of these cases is as follows:—

A cigar maker, named Adolphus Peart, his wife and 7 children, lived in a small house of two apartments. Three of the children, Constantine, Adolphus, and Ruby, aged 8, 5, and $3\frac{1}{2}$ years respectively, were a little out of sorts and had a slight attack of vomiting during Wednesday, September 4th, 1912, but were not sufficiently ill to call for any treatment, and at night the whole family retired apparently in ordinary health. About midnight, the youngest (Ruby) again began to vomit, and shortly afterwards Adolphus and Constantine did the same. This, however, seems to have ceased temporarily and all three went off to sleep again. In the early morning the second child (Adolphus) woke up, asked for some food, but before he had had any went off into a convulsive attack; the other two, Constantine and Ruby, within a short period were also attacked by convulsions, and all three lapsed into a state of coma. A doctor was called in, but soon after 7 a.m. the first one attacked (Adolphus) died. The other two were brought to the hospital at 9 a.m., suffered at intermissions of a few seconds from convulsive seizures, the spastic condition of the neck especially not completely relaxing in the intervals, and the younger (Ruby) died at 10 a.m., the older (Constantine) at 10.55, without recovery of consciousness in either case.

In the meantime the eldest girl of the family, Ethel, aged $14\frac{1}{2}$ years, started to vomit, and in a few minutes became, to a certain degree at least, unconscious. She was also brought to the hospital, arriving at 9.30 a.m. When I saw her at 10.30, with Dr. Thomson, the medical officer in charge of the ward to which this patient had been admitted, she had recovered consciousness, but showed rigidity of the neck and possibly of the spine, and while being examined had a convulsive attack; this was repeated, but the convulsions were not so severe as in the case of Constantine; nevertheless, the patient sank more deeply into coma and died at 5.55 in the afternoon. Thus four of the children had died between 7 a.m. and 6 p.m. the same day.

No dietetic error could be discovered in any of the cases, and apparently the only previous history obtainable was of a "cold in the nose" for two or three days preceding. This, however, had been disregarded, as the air of Kingston is somewhat dust-laden after the prolonged drought, and "colds" are common.

Post-mortem examinations were held in all four cases, the details of three of them, performed by me, will be spoken of shortly, after the completion of the history.

At the funeral of these four, on September 7th, another sister, Violet, aged 11 years, suddenly complained of headache, vomited, and became collapsed and semi-conscious. She, too, was hurried off to the hospital. She had recovered consciousness by the time she arrived, but showed a slight degree of rigidity of the neck, Kernig's sign was present on the right side, but to a much less degree on the left (in fact, it is doubtful whether it could be said to be definitely present on the left side at all). Vomiting was effortless and not accompanied by marked nausea; the pupils were equal and somewhat dilated. This patient is making a good recovery.

The pathological findings in these cases were:—

Cerebro-spinal fluid was taken by lumbar puncture from Constantine, Ethel, and Violet (Ruby was dead and Adolphus had died at home). The fluid in the first two was clear, in the last distinctly turbid. Enumeration of the leucocytes in that of Violet revealed 92 per cent. of the polymorphonuclear variety, and in several of these were small Gram-negative diplococci. Cultures were made of all three, and in every case the meningococcus was isolated. "Nasgar" was the medium employed. The nature of the organism was proved by sub-cultivation on various media and by fermentation tests.

The organism was also obtained from the ventricular fluid of the child, Ruby, post-mortem.

The gross post-mortem signs were similar in every case, but were more marked in Ethel, who had been longest ill. There was distinct pearly haziness over the surface and base of the brain and spreading down the spinal cord, with excess of fluid (from this fluid also was the organism cultivated), while in the case of Ethel, the whole surface of the convexity, and still more marked at the interpeduncular space at the base of the brain, showed a thicker pearly layer, with here and there definite flakes of lymph.

These meningeal signs, then, were common to all. The only other morbid conditions found were, in the case of Constantine, some œdema of the lungs and some scattered petechiæ on the surface (he had exhibited the most violent convulsions), and in the case of Ethel there were firm adhesions of the pleura of the left lung of

old standing, and less marked and less firm of the right. There were *no signs of tubercle anywhere in any of the cases.*

It should be stated that the viscera of all four who died were sent in sealed jars to the Island chemist for examination, but no signs of any poison were discovered.

The initial "catarrhal" symptoms in these cases were in all probability what have been noted as "premeningeal catarrh," set up by the presence of the organism at its "site of election" in the upper part of the naso-pharynx, whence it spreads by way of the nerve canals through the cribriform plate of the ethmoid to reach the meninges.

The mother, her baby, and a son, Reuben, were admitted to hospital for observation in the isolation ward, and swabs were taken from the upper reaches of the naso-pharynx in each case. The meningococcus was obtained from the boy's throat, not from the other two. He is, therefore, "carrying" the organism, and has been detained at the hospital. Further examination will be made to see later on whether he still harbours the coccus. Authorities state that it is rarely found after three weeks.

The above history is typical of nearly all acute cases of vomiting sickness, so I venture to hope that this unexpected series of cases may lead to the saving of many lives, owing to the discovery of the causative organism; for vomiting sickness is a disease which works great havoc in the centres in which it becomes epidemic during the colder months of the year.

I have prepared a considerable amount of meningococcus vaccine, and should any more instances occur before the arrival of the serum, I would suggest the use of this vaccine, which should be beneficial in some degree at all events in those cases which by their severity are probably associated with meningococcæia.

To sum up :—

(1) In four cases, presenting the typical symptoms of "vomiting sickness," the *Diplococcus Intracellularis Meningitidis* of Weichselbaum has been isolated.

(2) The organism was obtained from the cerebro-spinal fluid of all those from whom it was taken during life and from the ventricular fluid post-mortem.

(3) The organism was obtained from the throat of one of the contacts of these cases, though himself apparently in perfect health.

(4) The intra-cranial post-mortem signs are such as are consistent with death from cerebro-spinal meningitis at an early stage, that is, in "Foudroyante" forms of the disease.

The remaining matters, though of interest, do not call for such detailed descriptions as the foregoing, and, though important, are not sufficiently remote from the ordinary routine work of a laboratory to require more than a few words :—

1. I have met with five more cases from which the *Bacillus Serofaciens* (wrongly transcribed "Seroficus" in the former report) was isolated. This was described in the October, 1911—March, 1912, report, and in the "Journal of Tropical Medicine and Hygiene, as a peculiar condition of *Bacteriœmia,* but with special localisation apparently in the marrow of or the tissues surrounding the long bones. In all five there was the same intense swelling of the thigh, associated with very little pain except on movement; a temperature ranging from 99° to 101° F., rarely higher. The swelling in each case gave fluctuation and consequently incisions were made, but with one exception no pus was found, merely an extensive collection of serous fluid, from which the organism grew abundantly. The bacillus did not in any instance disappear from the blood until the temperature had reached normal to stay there. The bacillus was fully described in my April report. It does not coincide with any organism with which I am acquainted; and I therefore suggested the name *Bacillus Serofaciens,* owing to its causative action in producing the large serous collections.

2. Colitis and dysentery have occurred fairly frequently, particularly in a certain district where the inhabitants used as a laundry the stream from which they obtained their drinking water. This water on analysis was, as would be expected, very polluted, there being some 40,000 blood-heat organisms developing per cubic centimetre. Several of the cases in this part terminated fatally.

Among dysenteric cases both the amœbic and bacillary forms occurred. Of the latter the majority were due to the Flexner organism, but from one patient the Shiga-Kruse bacillus was isolated. This, I believe, is very rare in the West Indies.

3. Vaccine therapy is taking a strong hold amongst practitioners all over the Island. Apart from stock vaccines, 65 autogenous ones have been made, and in almost every instance the reports upon their results have been favourable, and in the majority remarkably so. Details of these have been given in former reports and need not be repeated here.

In three cases of lupus, two of which were very extensive, Tuberculin, starting with quite small doses and increasing gradually at short intervals, has given astonishingly good results.

4. Bacterial analysis of water supplies was carried out, as before, by the Agricultural Department during the month of April, but the following month this work was again relegated to me, and since then 52 samples have been submitted to examination.

Since the beginning of the present official year, April 1st, part of my duties consists in performing any autopsies required at the hospital and in making the necessary cultural bacterial examinations of sectioning of tissues which may be required to elucidate the causes of death. Twenty-six of these special post-mortem examinations have been performed by me, of which the most worthy of note are :—

(1) Four cases of cerebro-spinal meningitis.
(2) Sarcoma of pancreas, apparently primary.
(3) Addison's disease.—This condition has never been recorded in Jamaica. The patient came to hospital in a weak state and became more and more asthenic, no cause for his progressing weakness being found clinically. At the post-mortem the adrenals were found enlarged and caseating.
(4) Malignant growth of lung.
(5) Stab of abdomen, passing through the liver and severing the portal vein.
(6) Sarcoma of kidney in a child of 7 years of age; the tumour mass weighed 31½ ounces after the contents of a cystic part had been lost.
(7) Abscess of brain, tuberculous.

Appended hereto are two temperature charts of cases referred to in the section on enteric fever, and also a tabular statement showing how the large number of specimens dealt with has been comprised.

I have, &c.,
H. H. Scott,
M.D., London,
Government Bacteriologist and Pathologist to the General Hospital.

The Acting Superintending Medical Officer,
Island Medical Office.

Tabular Statement of Work Done between April 1st and September 30th, 1912.

Widal blood-serum reactions	553
Blood examinations for malarial parasites	475
Fæces for anchylostome and other ova	253
Fæces for isolation of *B. Typhosus*, &c.	91
Urines	168
Pus examinations for organism	121
Sputum examinations	108
Vaccines, autogenous	65
Water, bacteriological analyses	52
Tissues, for section	55
Rats, dissected	853
Post-mortem examinations	26
Miscellaneous, including :— Examination of gastric contents, blood-cultures, cerebro-spinal fluid, throat-swabs, pleuritic and other fluids, urinary calculi, stock vaccines, Wassermann	196
Total	3,016

No. 5.

MALAY STATES.

THE HIGH COMMISSIONER to THE SECRETARY OF STATE.

(Received June 17, 1912.)

SIR, Government House, Singapore, 22nd May, 1912.

WITH reference to my despatch dated the 8th November, 1911,* I have the honour to transmit a report on the work done at the Institute for Medical Reseach, Kuala Lumpur, for the period October 1st, 1911, to March 31st, 1912.

I have, &c.,

ARTHUR YOUNG.

Enclosure in No. 5.

REPORT FROM THE INSTITUTE FOR MEDICAL RESEARCH FOR THE PERIOD OCTOBER 1ST, 1911, TO MARCH 31ST, 1912.

BERI-BERI.

Further work has been carried out with a view to the isolation from polishings of the important substance the absence or deficiency of which in polished (white) rice is the cause of that foodstuff, when consumed as the staple of diet, giving rise to beri-beri. The researches have not been productive of any striking results. It is true that the weight of substance necessary as a protective or curative agent has been considerably reduced, and consequently the percentage of essential substance contained in the remedial agent increased, but that substance has not been isolated in a state of purity. The amount of this substance required for the maintenance of health among rice eaters is extremely small, and it is thermostabile.

With an essential organic substance present in considerable quantity in a mixture of organic and inorganic substances the methods of separation employed in organic analysis are satisfactory. With an organic constituent present in minute amount in the original mixture, and necessitating operations being carried out on large quantities of material, the methods in which separation is not complete, and which cannot be carried out quantitatively, will, in all probability, fail to isolate so elusive a substance.

Dr. Funk claims to have succeeded, but the evidence put forward by him is not conclusive.

Dr. Schaumann adheres to his original view that beri-beri is caused by the consumption of rice which is deficient in some organic compound of phosphorus; in view of the failure of this explanation to account for the phenomena observed, he has sought to add complexity to a problem already of sufficient complexity by the introduction of the term "activator" as a name for a hypothetical body the activity of which is evinced only in the presence of organic compounds containing phosphorus.

Dr. Funk has shown that the active substance is contained in a mixture free from phosphorus, and the researches carried out here have shown that the activity of the essential substance is not more dependent on the presence of phosphorus than it is on the presence of any other of the food constituents, such as protein, carbohydrates, salts, and the like.

It is, therefore, futile, in view of these findings, for Dr. Schaumann to adhere to his contention in regard to phosphorus compounds.

Dr. Bréaudat claims that the essential substance is a nucleo-proteid, but as it has been shown that the essential substance can be contained in a mixture which is free from phosphorus his claim is untenable.

What we stated three years ago in regard to phosphorus remains true to-day, namely, that the phosphorus content of rice is an indicator of the extent to which the rice grain has been deprived of its subpericarpal layers in which the essential substance is contained, and that the phosphorus content of a rice is in direct proportion to its content of essential substance; a high phosphorus content indicates a high content of essential substance and *vice versâ*.

[The author here discusses certain statements made by Dr. Simpson and Mr. Edie in a paper published in the "Annals of Tropical Medicine and Parasitology" Vol. V., p. 317.]

As illustrating the value of unpolished rice in the prevention of beri-beri, the following paragraph is quoted from the "Bangkok Times" of the 11th April, 1912:—

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* No. 7 in Appendix VI. to [Cd. 6024], February, 1912.

"Nearly two years ago there was a good deal of beri-beri amongst the Customs guards at the different stations along the river. The use of polished rice was discontinued, and the only kind supplied was the undermilled variety known as No. IV. Siam, in which a large part of the phosphorus is retained. This is milled by the Borneo Company, Limited, to meet the demand that has arisen as a consequence of the accepted medical view with regard to beri-beri. During this period the cases of beri-beri averaged barely one a month. From last December the use of white polished rice was again resumed, owing to the Borneo Company ceasing to mill. Last month beri-beri again began to be noticeably present amongst the guards, and in one station, containing just over two hundred men, there were 19 cases last month. The loss involved in having a growing number of men on the invalid list is very considerable."

It is not to be expected that the results of our researches should meet with general and immediate acceptance, but opposition to their acceptance should be based on accurately-ascertained facts; recently an attempt was made to revive the bacterial origin of beri-beri, to wit, the diplococcus of Tsuzuki; in a paper published in 1911 Tsuzuki entered into a lengthy explanation of the reason why he had been led into error, and disclaiming his diplococcus as the causative agent; later on, in the same paper, he shows himself to be a supporter of the work done by us.

It is necessary to direct attention to the fact that the isolation and identification of the essential substance contained in polishings is a matter of scientific rather than of immediate practical importance to those concerned with the prevention of beri-beri.

At the second biennial meeting of the Far Eastern Association of Tropical Medicine and Hygiene, held in Hong Kong, a large amount of attention was devoted to the subject of beri-beri, and the following resolution was adopted :—

> "That the accuracy of the opinion of this Association, recorded in 1910, has received further and more complete confirmation by investigators in Japan, China, French Indo-China, the Philippine Islands, Siam, Netherlands-India, the Straits Settlements, and the Federated Malay States, namely, that 'beri-beri is associated with the continuous consumption of white (polished) rice as the staple article of diet,'
>
> "It is, therefore, again desired to bring this opinion to the notice of the various Governments concerned, and to recommend international action."

The resolution adopted in 1910 was as follows :—

> "That, in the opinion of this Association, sufficient evidence has now been produced in support of the view that beri-beri is associated with the continuous consumption of white (polished) rice as the staple article of diet, and the Association accordingly desires to bring this matter to the notice of the various Governments concerned."

It is of interest to note in this connection that the Philippine Islands is the only country in which extensive application has been made of the results of our researches, and the results obtained there have been so excellent as surely to justify the adoption of the same or similar measures in other countries. It is, therefore, to be hoped that action will be taken on the resolution adopted.

We endeavoured to get the Society to adopt a chemical standard for the definite recognition of harmful and harmless rices, but the opinion was that the matter was one which should be left to the consideration of an international committee, doubtless to be constituted as a result of the resolution.

Harmful and harmless rices can readily be distinguished by simple inspection, but the definition of unpolished and polished rices on the basis of histological differences alone would not suffice for practical purposes, and it is necessary to have in addition a chemical standard.

The various constituents of the rice grain are not distributed uniformly throughout the cells, and it is for this reason that certain of these substances are available for the purpose of a standard or as an indicator of the extent to which the grain has been polished.

Roughly speaking the central part of the rice grain is composed of cells filled with starch grains. The cells of the peripheral layers, or, as we prefer to call them, the subpericarpal layers, are filled with fat; salts and proteins are also relatively more abundant in these layers. It is obvious, therefore, that the estimation of any one of these substances would answer the purpose; the one selected must be suited to rapid and accurate estimation, and there must be such a difference in the amount contained in the two kinds of rice as to allow for a reasonable margin of error.

The extraction of fat from rice is a tedious and troublesome process. The difference in the amount of protein contained in unpolished and polished rices is not sufficiently great to allow of a good margin for experimental error, and the ordinary process for the estimation of proteins is not really an estimation of these substances but of the nitrogenous constituents of the grain which are capable of being converted into ammonia by a process of reduction.

The estimation of one or other of the inorganic constituents is to be preferred on account of the relative ease and accuracy with which the determination can be carried out. We originally employed the phosphorus content for this purpose, and in all subsequent experiments and observations have found it in every way satisfactory as an indicator of the extent to which rice has been polished. A safe or harmless rice, that is one from which not more than the pericarp or skin has been removed in the process of polishing, will invariably yield more than 0·4 per cent. of phosphorus pentoxide, while a dangerous or harmful rice, that is one from which the subpericarpal layers have been removed, will yield considerably less than 0·4 per cent.

The standard of 0·4 per cent. of phosphorus pentoxide is, therefore, not a high one, and the results of its application in practice could not operate unfairly upon anyone. Legislation on the subject of rice in its relationship to beri-beri prevention would of necessity demand the incorporation in the enactment of a standard such as this. No great degree of skill or training is required to distinguish polished from unpolished rice by simple inspection, but differences of opinion on this point would inevitably occur, and when referred to a court of law the decision would rest on the results of the chemical examination just as in the case of other foodstuffs, such as milk.

The standard of 0·4 per cent. of phosphorus pentoxide was fixed on the undried material; the percentage of moisture does not vary greatly among different rices, and no apparent advantage would be gained by requiring that the calculation should be based on the dried material.

The ravages of beri-beri always have been and always will be greatest among the labouring classes, who prefer polished rice and whose financial position is subject to fluctuations brought about by economic conditions over which science and medicine have no direct control. So long as these people are in regular employment and in receipt of good wages they can afford to supplement their rice ration with other articles of diet and in this way prevent the occurrence of beri-beri. But when adverse conditions prevail, their dietary becomes almost wholly a rice one and soon afterwards beri-beri makes its appearance among them.

The use of unpolished rice at all times by these people would prevent the disease occurring among them, but this desirable result will be achieved with difficulty, because to those who have been accustomed to the use of polished rice, unpolished rice has an objectionable appearance.

The education of this class of people to the advantages to be derived from the use of unpolished rice must be a slow process, the result of which we cannot forecast, but it is a moot point whether, on the whole, this plan might not prove to be the most successful.

Undue haste in the application of the results of scientific research to practical and actual conditions has so often in the past been attended by unsatisfactory and even disastrous results that anything in the nature of sumptuary legislation should be introduced only after grave consideration. It has been proposed by legislation to make the use of unpolished rice compulsory. With this object in view, it has been suggested that the importation of polished rice should be prohibited, but despotic legislation of this kind would be dangerous, impolitic, and in certain places a serious menace to trade. Another proposal has been to tax polished rice. Such a tax to be in any way effective would require to be a heavy one; it would be most troublesome to apply, and in the case of a large transhipment port such as Singapore would seriously interfere with trade.

If it is agreed that some form of legislation is necessary, then in the conditions in which we find ourselves in the Malay Peninsula a tax upon polished rice at the point of distribution appears to offer some advantages. To accomplish this, it has been proposed to license dealers in polished rice, but it is doubtful if even this method in actual practice would yield results commensurate with the trouble entailed in its application.

It is necessary once more to emphasise the fact that a harmless rice can be

converted into a harmful one by an unsatisfactory process of cooking, and energetic action is required in order to secure the cooking of rice in ordinary pots and to do away with all apparatus in which the rice is cooked by steam under pressure.

Regarding the treatment of patients suffering from beri-beri, arrangements are now being made with a large firm of manufacturing chemists to prepare a remedial agent on the lines indicated by our researches. With this preparation observations will be carried out and the results published in due course.

Malaria.

During the past six months, Dr. Stanton has continued his investigation of the factors concerned in the propagation of malaria.

A large number of anophelines taken in nature or bred from larvæ were examined for the exact determination of species. Since the excellent work of Dr. Leicester some years ago, no revision of Malayan species has been undertaken and an examination of our own collections and specimens kindly placed at our disposal by the Central Malaria Bureau of India showed that much confusion had been introduced by the hasty description of new species. Not only had the same species been described and referred under different names—for example, *N. fuliginosus* of India was found to be identical with *N. nivipes* of Malaya—but, what is more confusing, different species had been described and referred to under the same name—the *N. willmori* described by Dr. Leicester was found to be identical not with *N. willmori*, James, but with *N. maculatus*, Theobald. One practical result of this chaotic state of nomenclature is that the knowledge gained of the habits and habitats of anopheline species in relation to malaria in the one country is lost so far as its application to the circumstances of the other is concerned.

It became necessary therefore to re-examine a large series of local species for the purpose of an accurate revision. This work has now been completed, and when the specimens have been compared with the type specimens in the British Museum, it is proposed to publish a revised account of Malayan species. The assistance of Colonel Alcock, F.R.S., and other members of the Entomological Research Committee has been kindly promised in this connection. The vexed question of classification of anophelines has recently been raised once more, and until some agreement is arrived at, the generic names here employed must be regarded as subject to revision.

It is of great practical importance, in connection with the mapping out of areas of distribution of anopheline species, that it should be possible to identify species from larval characters with a reasonable degree of certainty. Apart from India this question has received little attention at the hands of workers in tropical countries. In the course of the present investigation several new observations have been made, which it is believed explain some of the difficulties hitherto encountered. Grassi was the first to direct attention to the fact that certain larval characters such as the frontal hairs might be employed for the recognition of species. Subsequent observations appeared to show that these characters were not constant for the same species and the method of identification fell into disrepute. A series of observations on larvæ hatched out from the eggs of known species has revealed the fact that the characters vary at different stages of development, unbranched frontal hairs in the recently hatched larvæ of certain species being replaced by branched hairs at subsequent stages. This is true for the following species, *M. sinensis, M. albirostris, M. umbrosus, N. fuliginosus, and N. karwari*, and it has been found that the characters of the mature larvæ are constant in each of these species. It is believed that this will hold true generally, and it is proposed therefore to include with the account of Malayan anophelines a description of the various larval stages of those species which are now known. The mature larvæ of *A. fragilis, M. albirostris, M. umbrosus*, and *C. kochi* will be described for the first time and descriptions of the larvæ of *N. karwari, N. maculatus*, and *N. fuliginosus* will be revised.

For the determination of the species of anophelines which are effective carriers of malaria in this country adults taken in nature and others fed on cases of malaria were dissected. Of the species dealt with, the following have been found to become infected with the parasites of malignant malaria, *M. albirostris, N. maculatus*, and *N. fuliginosus*. The first two and also *M. sinensis* have been found infected in nature. The following species have so far given negative results on feeding, *M. rossi, M. barbirostris, M. umbrosus, C. kochi*. Further experimentation along these lines

will be necessary for the acquirement of complete information in regard to the transmitting agents of the different species of malaria parasites.

Judged by the ease with which *M. albirostris* is infected under experimental conditions and by analogy with the closely allied species *M. funesta* in Africa and *M. listoni* of India, it is considered probable that this species is a most important agent in the transmission of malaria in this peninsula.

In the examination of anophelines captured in the Pudoh Gaol, Kuala Lumpur, a curious association of a small biting fly with anophelines has been noted. In about one *per centum* of female anophelines taken, one or sometimes two flies were found with their probosces buried deeply in the mosquito's abdomen, sucking blood from the stomach. The fly, which is a species of Ceratopogon or Culicoides as yet unidentified, has been noted on the following anopheline species, *M. rossi*, *M. albirostris*, *M. sinensis*, *N. karwari*, *N. maculatus*, *N. fuliginosus*. As several of these anophelines are known carriers of malaria an interesting question is raised as to the part which these small midges may play in the dissemination of that disease.

The spleen and parasite rates in different areas in the peninsula have been taken and recorded with a view to testing the effect of various measures designed to diminish malaria. There is already much evidence that the problem of prevention is by no means a simple one, and the presence even in large numbers of malaria-carrying species of anophelines is at most only one of the factors which make for a high malaria rate among groups of labourers. Inquiry as to the other factors which are in operation will, it is anticipated, shed additional light upon the question of malaria prevention.

Plague.

The work on this subject has been carried out by Dr. Fletcher, who furnishes the following report:—

The investigation was undertaken with the object of determining if any of the rats of Kuala Lumpur are infected with plague; if so, to what extent the disease exists among them and if it is likely to give rise to a human epidemic.

An attempt was made to determine what species of rats are the commoner in the town, whether rats are numerous or few, by what kinds of fleas they are infested, and to what extent.

The amount of material available was small and the period of the investigation limited; the reliability of the conclusions is considerably weakened thereby.

In November, 1911, a case of plague was brought to the District Hospital from a vegetable garden on the Stapak Road just outside town limits. Shortly afterwards, a case occurred nine miles away in the mining village of Sungei Besi; there were, moreover, rumours that plague had occurred in the town of Kuala Lumpur and that it had been concealed from the Sanitary Authorities.

Proportion of Rats found to be Plague-infected.

Towards the end of November the Health Officer forwarded some dead rats to the Institute for examination, and from that time until the 9th of April 571 rats were examined for plague. Of these rats, 367 were picked up dead and 204 were caught alive.

One only of the live rats was found to be suffering from plague—a rat caught on the 5th of February near the village of Stapak.

Seventy-four of the dead rats, *i.e.*, twenty per cent., were plague-infected.

More than half the plague rats were picked up in December.

The following table shows the numbers of rats examined each month and the number found to be plague-infected:—

Month.	Live rats.	Dead rats.	Plague-infected.
November 22-30	—	58	4
December	18	156	46
January	63	99	16
February	100	54	9
March	16	—	—
April 1-9	7	—	—
Total	204	367	75

Rat infestation of Kuala Lumpur.

No record was kept by the Sanitary Board of the number of traps set each day; but the inspector in charge of the work informs me that from December 13th to the end of February more than 20 were set daily and all the rats caught were sent to the laboratory for examination. During this period, 126 live rats were received from the Sanitary Board. Assuming that all these had been caught in the traps, the rate per hundred traps set would be 8, but, as more than half these rats had been pounced upon in street drains by the scavenging coolies, the true rate is less than four per hundred traps. This is a very small number when compared with the number of rats obtained in plague-infected areas in India.

Though it is unsafe to place very much reliance on a comparison between the results of setting traps here and in India, the small number of rats caught is suggestive of a small rat population. This deduction is supported by an examination of those houses in which plague rats were found; they showed but little evidence of rat-infestation. In many shops bars of soap were stored, cheaply bound books and many dainties dear to rats, but only in one shop had the soap been nibbled by rats. In those shops where sugar and grain is stored it is rare to find rat holes in the sacks. There are very few rat holes in the houses and rat droppings are rarely seen.

Another fact which tends to show that rats are scarce in Kuala Lumpur is that 25 cents were offered for each live rat brought to the Laboratory; traps were lent to all who applied; shopkeepers and others were supplied with them. Very few rats were caught, however; no more than 103 in 66 days. This is in great contrast to Canton where, in 1894, an official offered 10 cash for every dead rat, with the result that 35,000 were collected in one month.

One of the essentials in the rise of a rat epizootic and consequent human epidemic is a sufficient number of susceptible rats.

The proportion of dead plague-infected rats—twenty per cent.—is high.

Live rats suffering from acute plague are never caught in large numbers; they are too ill to be tempted by the bait of the trap.

Species of Rats.

Mus rattus.—Most of the house rats found in the Kuala Lumpur district belong to this species, eighty-six per cent. of the rats examined being *Mus griseiventer* (Bonhote).

The colour of this rat is very variable, especially over the belly. It is generally of a dark, sepia colour with dark-grey fur on the abdomen. The feet and tail are uniformly dark, and the rings of the latter are fairly close set and regular. The tail is longer than the combined length of the head and body.

The average weight of an adult *M. griseiventer* is more than that of the Indian *M. rattus*, which weighs on an average 145 grammes. Of the rats in Kuala Lumpur 8·4 per cent. weighed over 200 grammes.

M. griseiventer is essentially a house rat. It does not nest in burrows, but in collections of undisturbed rubbish, such as are found under the wooden platforms upon which sacks of grain are stored in Kuala Lumpur, in the surplus stock of shops stored in accessible lofts under the roofs, and probably among the old rags and papers which collect beneath the wooden floors of cubicles.

In a few of the rats, especially among those brought from the suburban districts of Kuala Lumpur, the abdomen is very light coloured, and the feet are almost white.

Less than 1 per cent. of the rats are *M. concolor* (Blyth), a small house and field rat which is generally regarded as a small form of *M. rattus*. The colouring of this rat is simlar to that of *M. griseiventer*, but it is generally darker, especially about the feet. The tail; which is longer than the head and body, is dark with well-marked rings close set and regular. There are numerous stiff spines in the fur of the back. The ears on both this and the preceding species are proportionately large. One of the *M. concolor* rats examined was plague-infected. This rat is not found except eastward of the Indian Peninsula.

The skulls of rats of the species *M. rattus* are much more dome-shaped than those of the Norwegian rat. This can be demonstrated in recent specimens by making a longitudinal cut through the skin over the top of the head, and laying bare the *calvarium*.

One example of *M. jalorensis* was caught in the flood during the storm which visited Kuala Lumpur on December 22nd. It is a little smaller than *M. griseiventer*, and is a field rat which may enter houses for food, sometimes making its home there. With its reddish brown, almost auburn, back and its creamy white belly it is a rat of more brilliant coloring than the domestic varieties.

Nesocia bengalensis and *N. bandicota* have not been found in the Kuala Lumpur District. They are known to occur in Singapore and Penang, where they have been introduced from Rangoon.

Mus musculus.—The common house mouse furnished 7 per cent. of the rodents examined; no fleas were found on any of them. Two of them had died of plague. Mr. Boden Kloss informs me that the mouse is a new arrival in this country, but that it established itself in Singapore and Penang some time ago.

Pacchyura murina.—The musk shrew is very common in this district. The number brought to the laboratory would have been larger but that no reward was offered for them in view of their harmlessness as carriers of plague. None of those examined were plague-infected. This animal is not a rodent, but belongs to the order *Insectivora*, and is related to the moles. They live and breed in undisturbed collections of merchandise, behind boxes, in old bags and lumber rooms.

The shrew freely attacks and kills *Mus rattus;* placed in a cage with a young *M. rattus*, it will kill and devour it.

The Indian Plague Commission consider it probable that it is one of the factors responsible for the scarcity of rats in Eastern Bengal, and consequently for the freedom from plague of that district.

The numbers and reproduction of rats and their effect on the efficiency of rat destruction.

When undertaking rat destruction it is useful to have some idea of the number of rats present in the affected area, and also to know the rate at which they reproduce. Although rats appear to be scarce in Kuala Lumpur it is unlikely that there are less than one for each human inhabitant, say, about 40,000. Rats are very prolific. It is found that the commonest number of young at a birth is six; that the interval between the births is about 50 days; and that (supposing there were no deaths) a single pair may produce 198 young in 12 months and 858 in 16 months. Assuming that the rat population of Kuala Lumpur is 40,000, and that some 10,000 of these are adult females, this means that if there were no deaths they would produce to the extent of about one million in one year.

As the number of rats in the town is presumably stationary, it is evident that the natural death-rate amongst them must be enormous. Owing to disease and the eating of the young by their parents, it is probable that not less than 400,000 rats die in Kuala Lumpur in 12 months. This being so, it is evident that by catching 100 rats every month, or 1,200 in a year, no appreciable difference can be made in the total rat population.

An epizootic of plague itself has probably more effect in reducing the number of rats than any artificial means; but from 20 to 50 per cent. of rats are immune to plague, and so great is their fertility that their numbers are soon restored to the maximum which the district will support.

Many consider that domestic cats have an appreciable influence upon the number of rats. In Kuala Lumpur, where rats are comparatively scarce, it is probable that the keeping of domestic cats may have beneficial effect by reducing the numbers of these rodents.

Examination of houses from which plague-rats were received.

Nearly 50 per cent. of the plague-infected rats came from that small stretch of Ampang Street, about 150 yards long, lying between Cross Street and Java Street.

The houses in this part of Ampang Street have a narrow frontage of some 18 feet, but they extend back from the street to a depth of 120 feet or more. Except for a small part in front, which is used as a shop, most of these buildings are warehouses in which an extraordinary amount of goods is stored. A great part of the trade is wholesale, these shops acting as agents for the supply of rice and other provisions to mines, rubber-estates, retail merchants, &c. None of these houses has a wooden or earthen floor; all are paved with cement or with large, red Malacca-tiles.

At the back of the house—in most of them—there is a kitchen or bathing place, and from this an open brick drain covered with planks runs right through the house to the front of the shop and under the pavement of the five-foot way into the open drain at the side of the street. The plank covering of the house-drain is usually buried beneath sacks of grain or other heavy articles, so that the drain is not often cleaned. The open cement street-drain forms a convenient highway for rats, which can readily gain access to the houses by the house-drains leading into it. Some 80 yards away the main drain empties into the Klang River, here a shallow and muddy stream with irregular foul banks covered with reeds, rank grass, and collections of garbage.

The shops in this area are all one-storied houses. As a rule the upper stories are without ceilings, the roof is tiled. In some there is a wooden ceiling over the front part, and above this is a loft used for the storing of miscellaneous goods and rubbish. The upper story is generally well filled with merchandise, a portion of it is sometimes screened off as a bedroom. The walls of these houses are of brick—some of them of old, crumbling, sun-dried brick. In a few cases one large house has been divided into two by wooden partitions.

A short time before the Sanitary Board began forwarding rats for examination the houses on one side of the road were pulled down. The backs of these houses were on the embankment of the Klang River. They were, for the most part, shops where dried fish was sold. On the other side of street farther from the river the rat population would be increased by those turned out of the shops which had been pulled down.

In this portion of Ampang Street there are 25 houses—the odd numbers, 1 to 49 Ampang Street, and No. 1 Cross Street. All but six of these houses sell food-stuff of some kind. Eleven of them are shops for the sale of sugar, salt, rice, and grain.

In the grain shops the sacks are stored on wooden platforms made of thick, heavy planks raised 3 or 4 inches above the cement floor.

Some of the houses in this part of Ampang Street furnished several plague-rats. Nine were brought from number 21, a grain-shop. There are no obvious signs of rat infestation beyond a few holes in the floor upstairs.

No. 25 Ampang Street is a fancy-store between two grain-shops. Five plague-rats had been found here and a cat had died, possibly of plague, but very few traces of rats were found on inspection.

Thirty-six of the 75 plague-rats were found in Ampang Street. Of the others some were found in streets near, such as Java Street and Malay Street.

There was a second focus of infection about half a mile away, in Petaling Street, spreading into Sultan Street and High Street. The greater part of the infected houses in the second focus also consists of eating-shops or grain-shops. Some are lodging-houses. In one of these two long rows of cubicles, like small horse-boxes, run the length of the house from back to front with a narrow passage down the middle between the two rows. The cubicles downstairs are very dark, and one cubicle, measuring 8 or 9 feet square, sometimes accommodates a whole family. The ground floor is of Malacca-tiles, but the cubicles have wooden floors raised 2½ feet above the tiles, the space underneath being filled with miscellaneous rubbish forming excellent breeding places for rats.

Examination of Rats for Plague.

Method of examination of rats.—After being weighed and measured the rats were stretched out and nailed on to boards and their glands and viscera examined. At first smears were made in all cases from the glands, spleen, and blood; in several instances cultures were made and guinea-pigs inoculated. Later, when it was found that the disease can be recognised easily by the naked eye, smears for confirmation were taken only from those cases macroscopically diagnosed as plague and from doubtful cases.

Pathological lesions.

Primary buboes were noted in 82 per cent. of the infected rats. The distribution of the buboes was as follows :—

	Per cent.
Submaxillary	78·69
Inguinal	13·12
Axillary	8·19

In some cases the primary buboes were very small, in most they were quite evident. In a few there was considerable hæmorrhage into them and into the surrounding tissue.

In three rats the buboes were caseating, in one there was a suppurating gland in the neck. There was some general enlargement of the lymphatic glands in the majority of the plague rats.

Sections of a typical bubo which has not suppurated show that the bacilli are not limited to the gland. They are numerous in the capsule, and are to be found in the areolar tissue surrounding the gland. In this areolar tissue there is an infiltration of small cells, and frequently some hæmorrhage.

Within the gland there appear to be comparatively few lymphocytes. The lymphatic sinuses are crowded with erythrocytes. There are also many polymorpho-nuclear cells and some endothelial cells; many are undergoing karyorrhexis, and in the centre of the gland there is commencing necrosis. A fine brown pigment is scattered over the section, and is due to blood destruction.

Subcutaneous congestion was present in 81 per cent. In the majority of the plague rats this was very distinct; in many the redness of the skin was noticeable before the rat was cut up. In some, there were small subcutaneous hæmorrhages, while in others, on reflecting the skin, the congestion amounted to no more than a pink blush.

Fluid in the chest was found in 45 of the 74 plague rats, *i.e.*, 60 per cent. In all cases except five this fluid was clear; in these five it contained blood. In two cases this hydrothorax was the only macroscopic sign of plague. All those rats which had fluid in the chest were found, on microscopical examination, to have died of septicæmic plague, except two or three which had received injuries causing hæmorrhage into the thoracic cavity.

Liver. In 40 cases, *i.e.*, 54 per cent., macroscopic changes were found in the liver. In nearly all these cases it was slightly swollen. In many it was pale. In some, the surface was stippled like Morocco leather; in others, it was peppered over with minute lighter patches; and, in a few, it was a very bright red.

Sections of the liver stained with Hæmatoxylin and Eosin contain minute red areas which have taken up the Eosin stain only. These patches, consisting of focal necroses, are sharply marked off from the rest of the liver tissue. In them the trabeculæ are shrunken—the nuclei stain badly or not at all; between these trabeculæ is coagulated serous fluid and granular debris.

The necrotic areas vary in size, sometimes occupying only a part of lobule, while in other cases a necrotic patch involves several. The edge of a patch may end sharply in the middle of a lobule; there is no correspondence between the arrangement of the lobules and the areas occupied by necrotic patches. There is no inflammatory zone round the patch and the change from necrosed to comparatively healthy tissue is quite abrupt.

In those parts of the liver not affected by this necrosis there is congestion and some increase of Kupffer's cells and of small inflammatory cells.

The bacilli are present in enormous numbers, chiefly in the capillaries. There are fewer bacilli present in the necrotic areas than elsewhere.

The giant cells described by Ledingham were not found.

Spleen.—The spleen was noted as being enlarged in many of the cases; but so it was in many rats which had not died of plague.

Sections of the spleen stained with carbol-thionine and differentiated with 0·25 per cent. oxalic acid show great numbers of plague-bacilli.

Scattered throughout the pulp are large masses of degenerated bacilli surrounded by broken-down necrotic material containing much nuclear debris.

There are no large clumps of bacilli in the Malpighian corpuscles; but in a few of them there are circumscribed areas of degeneration and these are full of bacilli. There are comparatively few lymphocytes present; the framework of the spleen is easily seen and the meshes are occupied by the ghostly remains of erythrocytes which have lost their hæmoglobin; debris similar to that found in the areas of focal necrosis in the liver. The nodes are smaller and appear to be more scanty than in a normal spleen.

As a rule, the bacilli are more scattered in the rat's spleen than in the spleen of a plague guinea-pig.

Lungs.—In seven cases the lungs were so affected as to attract attention at the post-mortem. In four there was general congestion; in three there was red-hepatization with hæmorrhages in patches and bloody fluid in the thorax. Apparently

the whole of the lungs was inflamed, but this inflammation was always more intense in the lower lobes.

There is great engorgement of the capillaries in the earlier stages; later, the alveoli are filled with a serous exudate which compresses and empties the capillaries. In some parts the capillaries have burst and the alveoli are full of blood. The epithelial cells of the alveoli proliferate very little. The bronchi are not affected to any extent, while in primary pneumonic plague they are intensely inflamed. There are large numbers of plague-bacilli everywhere, especially in and round the capillaries. In all these cases the pneumonia was secondary; the lungs being infected during a septicæmia occurring in a bubonic case.

Chronic and Resolving Plague.

One of the Kuala Lumpur rats examined had a cyst in the spleen containing caseous matter and was possibly suffering from resolving plague. Unfortunately the spleen was put into formalin, so that the diagnosis could not be confirmed by inoculation.

Three other rats were suffering from chronic or subacute plague.

(1) This rat had caseous submaxillary lymphatic glands which were adherent to the skin. The liver was much enlarged and like a nutmeg-liver with a few small caseating areas. In the chest was a quantity of clear fluid and microscopical examination showed that the rat had died of plague septicæmia.

In the neck-glands no plague bacilli were found on microscopical examination, but a guinea-pig inoculated from them died of plague.

(2) The lymphatic glands in the neck of this rat were large and pale. They contained cell debris but no plague bacilli were seen. The spleen was enlarged and the liver showed minute necrotic areas. Inoculation into a guinea-pig caused its death by plague.

(3) This rat had a suppurating bubo in the right groin and died of septicæmia.

Fleas on Rats.

Excepting a single specimen of *Ctenocephalus felis*, the only fleas found on the rats caught in Kuala Lumpur and its suburbs were of the species *Lœmopsylla cheopis* (Rothschild). This is the common rat-flea in Bombay and in South India, where it has been shown to be the agent which infects man by carrying the plague-bacillus to him from the infected rat. Excluding new-born rats, shrews, and mice, the average number of fleas per rat was 1·042. Seventy-eight rats were caught in the suburbs of Kuala Lumpur, the Pahang Road, Stapak, and the Central workshops. These were caught in wire traps. It was directed that when a rat was caught the trap should be enclosed in a khaki bag and brought to the laboratory. This direction was not always followed.

One hundred and twenty-six live rats were sent by the Sanitary Board Authorities. Very few of these rats were caught in traps. More than half of them were captured by the scavengers, who caught them with their hands in the open road-drains. These rats were always wet and were generally carried by a piece of string tied round the body, until they could be put into bottles and sent to the laboratory.

Wet rats harbour fewer fleas than dry rats. Moreover, the Indian Plague Commission has found that fleas leave rats which are exposed to sunlight, as these probably were while being taken to the Sanitary Board Offices. This probably accounts for the fact that there were more fleas on the rats caught in the suburbs, in traps, than on the rats caught in the town by the Sanitary Board coolies. It is probable that the rats caught in the drains and those which had been exposed to the sun had lost some of their fleas.

The average number of fleas found on rats caught in traps was 1·23 per rat. The largest number of fleas found on any one rat was twelve.

When a rat dies the fleas leave it at once and seek a new host. Very few fleas were found on the dead rats brought to the laboratory.

On several occasions guinea-pigs were used as flea-traps. First, they were chloroformed, combed with a fine comb, and thoroughly searched for fleas, but none were ever found on them. They were then left over night in houses where plague-rats had been found. The next morning they were again chloroformed and searched for fleas.

Forty-eight guinea-pigs were employed in this way; no fleas were found on any of them and none of them became plague-infected.

The Plague Commission in India found that if the guinea-pigs used as traps were confined in cages they did not pick up so many fleas as they did if they were allowed to run free. In several of the houses in Kuala Lumpur the people were very suspicious and refused to have the guinea-pigs at all; in most of the others it was necessary to leave them in their cages.

The only flea which is common in houses is the cat flea, *Ctenocephalus felis*, which infests dogs, cats, and sometimes goats. This flea will bite man, but it is not a vector of plague-infection.

The European rat-flea, *Ceratophyllus fasciatus*, which carries plague from animal to animal and readily bites man, has not been found here. Neither has the human flea, *Pulex irritans*, though it is possibly present in small numbers. Gimlette says that the flea, as a parasite of man, is unknown to the Malays of Kelantan.

The examination of rats and fleas in Kuala Lumpur has only been carried on for a few months, and it is possible, but improbable, that fleas are much more numerous at other times of the year. In view of the equable climate of the western side of the Malay Peninsula and of the lack of variation in both the mean temperature and the relative humidity, it is unlikely that there is any great seasonal variation in the number of fleas.

The annual mean temperature in Kuala Lumpur is 80·52° F., and the monthly means vary but little above or below this point. In November, December, and January it falls a little below 80° F. (in November, 1911, as low as 78·81° F.); in April and May it is sometimes as high as 85° F.

The rainfall is large and comparatively evenly distributed.

The relative humidity is about 75 per cent., but may fall as low as 60 in the hottest part of the day. There are no extreme seasonal variations at different times of the year.

Such conditions are stated to be unfavourable to the well-being of fleas and to the propagation of plague.

Other Parasites found on Rats.

All or nearly all of the rats in the Kuala Lumpur District harbour large numbers of parasites of the family *Gamasidæ*, probably *Lælaps echidninus* (Berlese). They are very small, do not possess the agility of the flea, and do not immediately leave their host when it dies. These parasites do not bite man, and therefore cannot convey the infection to him from the rat, but *Lælaps* do suck the blood of rats, and may convey the infection from rat to rat.

Two specimens of the common Asiatic bug (*Cimex rotundatus*) were found on the rats. Bugs are very plentiful in many parts of the Malay States, but they are seldom found on rats, and are certainly not important carriers of the disease.

Conclusions.

1. Plague exists as an epizootic among the rats of Kuala Lumpur, and the epizootic is severe.

2. The commoner, and almost the only, house rat in Kuala Lumpur is *Mus griseiventer* (Bonhote), a variety of *Mus rattus*.

Mus decumanus and Nesocia have not been found in Kuala Lumpur. Rats are comparatively scarce in the town, probably scarcer than in Eastern Bengal, where the absence of epidemic plague is attributed to the small rat population.

3. Almost the only flea found on the rats is *Loemopsylla cheopis* (Rothschild).

4. The flea infestation of the rats is less than 1·5 per cent., which is a very low figure.

Sporadic cases of human plague have occurred from time to time, but have never given rise to any considerable epidemic. From this evidence, the high mean temperature, and the scarcity of rats and fleas, one may conclude that Kuala Lumpur is unlikely to be visited by serious plague-epidemics. A severe rat epizootic is always a cause for alarm, and it is impossible to foretell the effect of changed conditions, such as a different drainage-system or the immigration of rats belonging to another species (e.g., *decumanus*).

Cholera.

During October, 20 fatal cases of suspected cholera occurred at the District Hospital, Kuala Lumpur, and were investigated with the object of determining the value of the examination of films made from the fæces in such cases.

Smears from three of the cases showed vibrios in almost pure culture. The post-mortem appearances and cultures were confirmatory.

In 11 of the cases the smears contained numerous vibrios; the post-mortem findings and cultures were confirmatory.

In two cases the smears contained few vibrios; subsequent investigation showed that one of the two was cholera and the other not.

In five cases the examination of the smears gave negative results. In two of these cases no autopsy was made, and in the other three the appearance of the organs was not characteristic, and attempts to isolate the cholera vibrio were negative.

Material from cases which occurred at the lunatic asylums, Kuala Lumpur and Taiping was also examined.

Cultures from the District Hospital cases, from the Kuala Lumpur lunatic asylum, and from the asylum at Taiping were agglutinated by immune serum in dilutions of 1 in 8,000.

All the cultures reacted positively to the saturation test, and none of them lysed blood corpuscles in less than 72 hours.

Pathology and Bacteriology.

The routine work in these departments continues to increase. A large number of specimens were submitted and examined for the Widal reaction; in several instances the agglutinating power of the sera for *Bacillus paratyphosus* A and B was tested, but with negative results. Sera from two cases of suspected Malta Fever were received, but neither of them agglutinated the *Micrococcus melitensis*.

The majority of the tumours received do not merit special consideration. An interesting case of *Myeloma Multiplex* came under observation.

This case occurred in a Chinaman aged 40. Three months before his death two tumours appeared, one in the neighbourhood of the right sterno-clavicular joint and the other in the right superciliary ridge. These tumours increased very rapidly in size and soon afterwards many others appeared in different parts of the body, chiefly on the head, back, and chest.

Smears made from the blood after death showed no definite leucocytosis. A differential blood count gave the following proportions of leucocytes :—

Polymorphonuclears	30·1
Lymphocytes	63·4
Eosinophiles	1·5
Large mononuclears	5·0

In the spleen the Malpighian corpuscles were small. There were no other changes.

The kidneys were unaffected except for a slight catarrh of the convoluted tubules, and a slight increase of fibrous tissue. There was no sclerosis of the vessels.

No urine was obtainable, so that the presence or absence of the Bence-Jones body could not be determined.

There was a large number of tumours arising from the skull, clavicles, ribs, and vertebræ. The long bones, the innominate bones, and the bones of the carpus and tarsus were unaffected.

The tumours had their origin in cancellous bone tissue. There was very little new bone formation; in some places just a little thickening at the edges of the lesions in the bones, but in many not even that. The tumours appeared to absorb and take the place of the bone in which they had originated. When the bone had been invaded by the new growth, the effect was much as though water had been dripping on to a lump of sugar. The tumours were all very soft—as soft as lard—and very white. There was a tendency for small satellite tumours to form in the connective tissue round any large one.

The neoplasms were not very large, but they were very numerous. They occurred at the junction of each rib with its cartilage, in most of the vertebræ, in the calvarium, in the base of the skull, and in the inferior maxilla. The right clavicle was fractured by a tumour originating at the junction of its outer and middle thirds.

There was one small neoplasm, the size of a pin's head, on the upper surface of the right lobe of the liver immediately beneath the capsule.

Over the pleuræ were innumerable small growths like miliary tubercles. No other viscera were involved.

The tumours were small, round-celled sarcomata, like lymphosarcomata, with a tendency to alveolar structure in some of the larger tumours.

Materials from suspected cases of plague, cholera, &c., were examined.

The complement-deviation test of Wasserman was applied in 19 cases with 7 positive results. The installation of a high-pressure water system and a water centrifuge will greatly facilitate the carrying out of this reaction.

Eighteen specimens of urine were submitted to biological, chemical, and spectroscopic examination. The number of cases in which hæmoglobin is demonstrated in the urine has increased greatly in recent years, and this may be taken as a fair measure of the extent and severity of malarial infections.

Autogenous vaccines were prepared from eight cases of localised bacterial infections, and their administration has been attended with satisfactory results.

The Klebs-Loeffler bacillus was isolated in two cases from throat-swabs. This is mentioned as of interest because diphtheria is uncommon in this country, only two or three cases being admitted to Government hospitals in a decade.

In several cases of conjunctivitis the diplo-bacillus of Morax-Axenfeld was shown to be the infecting agent. This micro-organism is not an uncommon cause of conjunctivitis in this country. The clinical history furnished and the objective symptoms are frequently characteristic. The curative results obtained by the instillation of a solution of sulphate of zinc (2 per cent.) into the conjunctival sac are very satisfactory.

Materials received from officers of the veterinary department included specimens of meat infected with Sarcosporidia, blood-films showing protozoal infections such as Piroplasmosis and Trypanosomiasis, also ticks and helminths from various domestic animals. Several outbreaks of fowl-cholera were recorded.

Chemistry.

The provision of an additional chemist and increased laboratory accommodation has facilitated the carrying out of the work in this department.

During the six months under consideration the total number of analyses was 596.

They included the following :—

Waters	34
Milks	166
Chandu and chandu dross	63
Morphine and cocaine	62
Counterfeit coins	128
Articles examined for bloodstains	30
Articles examined for poisons	28
Liquors	60
Miscellaneous	25

The analysis of waters included series of samples from the town supplies of Taiping, Klang, and Seremban.

Included in the milks are nine samples of curdled milks, most of which were found to contain added water. The vendors claimed that the usual process of curdling involved the addition of water, and the magistrate did not convict. The Health Officer is now taking steps to standardise the method of preparation.

Among the special investigations are included : The analysis of the flue gases of a furnace near Ampang where arsenical tin ore was being roasted. An estimation of the arsenic and sulphur was made and the proportion found to be very small.

Two samples of felspar were analysed for the Government Geologist, who is investigating the tropical weathering of igneous rocks. One was a sample of weathered and the other of unweathered felspar. The results confirmed the views of the Government Geologist.

Some samples of Chinese sand-crackers were received from the police department. The explosive contained in the crackers was found to be fulminate of silver, which was mixed with coarse sand. The proportion of explosive was found to be exceedingly small.

H. Fraser,
Director, Institute for Medical Research,
Federated Malay States.

No. 6.

MALAY STATES.

THE HIGH COMMISSIONER to THE SECRETARY OF STATE.

(Received 21 December, 1912.)

SIR, Government House, Singapore, 25th November, 1912.

WITH reference to my despatch dated the 22nd May, 1912,* I have the honour to transmit a report on the work done at the Institute for Medical Research, Kuala Lumpur, for the period April to September, 1912.

I have, &c.,
ARTHUR YOUNG.

Enclosure in No. 6.

REPORT FROM THE INSTITUTE FOR MEDICAL RESEARCH FOR THE PERIOD APRIL 1ST TO SEPTEMBER 30TH, 1912.

BERI-BERI.

It has been stated by L. Bréaudat that rice should be used as soon as possible after preparation, because, when stored, changes take place which convert a harmless rice into a harmful one.

In the experiments brought forward by him in support of this statement air freed from carbon dioxide is passed through rice contained in a flask, and the air thereafter passed through baryta water. A precipitate of barium carbonate, he considers, indicates that the rice is undergoing decomposition.

Experiments were carried out here on similar lines. In the first experiment a quantity of unpolished rice was prepared from padi by the primitive process of pounding and winnowing. A large flask was filled with the rice and fitted with a rubber stopper through which passed two glass tubes, one reaching to near the bottom of the flask, the other passing just through the stopper. Air was passed through a Wolff's bottle containing caustic potash, next through a Wolff's bottle containing sulphuric acid, and then through a Wolff's bottle containing solution of baryta. The air thus freed from moisture and carbon dioxide was passed through the rice and aspirated out by way of the shorter glass tube through two Wolff's bottles containing baryta solution.

On the first day air was aspirated for two hours through the rice. A slight turbidity was observed in the baryta water, indicating an amount of carbon dioxide not more than might have been in the apparatus. On the third day air was aspirated for one hour through the rice, and a fair amount of precipitate was obtained in the first Wolff's bottle, but none in the second bottle. The baryta solution was renewed, but no further precipitate was obtained. On the fourth day a considerable amount of carbon dioxide was extracted, and on the fifth day there was a slight amount. On the sixth day a considerable amount was obtained. In order to destroy insects, &c., chloroform vapour was now passed through the rice for some time, and the flask of rice filled with chloroform vapour was closed. On the ninth day aspiration yielded some carbon dioxide. On the eleventh day very little carbon dioxide was obtained. Chloroform vapour was again passed through the rice. On the twelfth day a trace of carbon dioxide was obtained. On the sixteenth day there was none. On the twenty-third and twenty-fifth days the results were also negative.

The rice was placed in a cloth bag and stored in a cupboard for three weeks. On the expiration of that period no carbon dioxide was obtained. The rice was then moistened with water and two days later much carbon dioxide was obtained.

In the next experiment, No. 1, Siam rice was employed. The rice was not, apparently contaminated with insects. No trace of carbon dioxide was obtained. Two days later some carbon dioxide was obtained. The rice was seen to contain

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* No. 5.

maggots, these were removed as far as possible. On the fifth day no carbon dioxide was obtained. On the seventh day there was a fair amount, and on the ninth day there was a large amount. Chloroform vapour was now passed through the rice. On the eleventh day there was a slight trace of carbon dioxide, and on the thirteenth day there was a large amount. The rice was now sprinkled with chloroform. On the seventeenth day there was a trace of carbon dioxide, but on the eighteenth and twentieth days there was none.

The rice was then placed in a bag and stored for twenty-four days. After that time it was returned to the apparatus; on the first day a trace of carbon dioxide was obtained, but on the following day there was none.

In the next experiment parboiled rice was employed. The sample contained numerous insects, these were removed so far as possible. Much carbon dioxide was obtained. The rice was then treated with chloroform. Six days later there was a trace of carbon dioxide. On the following day no carbon dioxide was obtained, and three days later it was still free from carbon dioxide.

The rice was placed in a cloth bag and stored in a cupboard for three weeks. On the expiration of that period it was tested and no carbon dioxide obtained

These experiments do not demonstrate the necessity for rice being consumed as soon as possible after milling, but they do emphasise the importance of care in the storage of rice, a fact already well known to dealers.

Harmless and harmful rices have been stored in this Institute for many months at a time and, estimated by the standards we have adopted, their values have remained unchanged.

In the report for the preceding six months consideration was given to the prevention of beri-beri, and the difficulties, so far as these can be anticipated, were dealt with.

Since then it has become more and more apparent that the primary and principal difficulty with which we have to contend is opposition on the part of medical officers. Despite the fact that our reports have been circulated freely to all medical officers in the Federated Malay States and Straits Settlements, it is exceptional to meet with an officer who understands what has been done. This result is only explicable on the assumption that the reports have either not been read or not been understood. Every effort was made to render these reports intelligible. The observations and experiments were, we believed, concisely stated, and no one has proved that the deductions made were either unsound or illogical.

Dr. Sansom, Principal Medical Officer, has made the following statement :—

> "All the evidence which has been accumulated goes to show that beri-beri is a disease caused by faulty nutrition, and aggravated when deficient nutrition is combined with work which demands a greater amount of energy than is supplied by such food as the sufferer takes. But I feel that it is wise to refrain from being too dogmatic, and affirm that beri-beri will entirely disappear if error in diet and non-adjustment of diet to work are corrected."

This statement can only be interpreted to mean that in this country the disease has more than one origin; for this we have no parallel in medicine, and no fact can be produced in support of the assertion. On a similar basis he might have stated that the bacillus of tetanus is a cause, but not the only cause, of tetanus.

Peripheral neuritis, it is well known, may be caused in various ways, but that form of peripheral neuritis which in this country is known as beri-beri has one cause and one only.

We have stated that even diseases of which poly-neuritis may not be a prominent feature, such as epidemic dropsy, ship beri-beri, Ceylon beri-beri, and the like have been included under the name beri-beri. It is not to be expected, therefore, that any single etiological factor will satisfactorily explain all the recorded outbreaks of so-called beri-beri. We sought only for an explanation of the origin of beri-beri as it occurs in this country, and that we claim to have found. The recent work on the etiology of this disease has been followed, and not a single fact has been recorded which is opposed to this claim.

Beri-beri can be prevented by the simple procedure of substituting unpolished for polished rice, and the rice must not be cooked by steam under pressure.

In continuance of the statement just dealt with, Dr. Sansom states :—

> "My experience in the Transvaal with 40,000 Chinamen was too significant to allow me to have such secure anticipation—the coolies referred to were specially selected—spent several weeks on a steamer, idle—consuming a most nourishing diet—on the mines the diets (supplied by the employer) were very liberal and of the best quality and capable of supplying all the energy needed to accomplish each day's work, yet we had hundreds of cases of beri-beri and a terrible death-roll."

Neither the constituents nor the composition of the diet are given, and the statement consists of nothing more than views and impressions such as might be furnished by any casual observer.

On pages 11 and 12 of the Studies from the Institute for Medical Research, No. 12, there is recorded the composition of the diets issued to those among whom beri-beri occurred and to those among whom beri-beri did not occur.

The calculations were made by the accepted methods for the estimation of diets, and, based on the accepted standards, neither diet can be considered unsatisfactory. The diet issued to those on parboiled rice did not differ to any appreciable extent from that issued to those on polished rice; yet the disease did not occur among those receiving parboiled rice and did occur among those receiving polished rice.

The diets issued in the Lunatic Asylum, Kuala Lampur during the time that Dr. Fletcher was carrying out his observations were far more liberal than those issued at Durian Tipus, and beri-beri only occurred among those receiving polished rice. Both diets, estimated by the usual standards, were most nourishing, and did not differ appreciably in their composition.

It was as a result of these observations that in 1910 I made the following statement to the Far Eastern Association of Tropical Medicine :—"I believe that the methods of estimating diets from the amount of proteins, fats, carbohydrates and ash contained in them will require reconsideration, and in all probability re-adjustment."

Dr. Brooke, as editor of the "Malaya Medical Journal," states :—

> "It would seem to us an infinite pity that, having established an apparent connection between the production of beri-beri and the consumption of over-milled rice, all investigators should proceed, like a flock of sheep, along the 'deficiency' track, which does not in the least lead to the tree of knowledge."

This statement could not have been made by one conversant with the facts on the subject.

Dr. Finlayson in his annual report states :—

> "Should the hypothesis of Dr. Schaumann and Drs. H. Fraser and Stanton be proved to be correct, undoubtedly a distinct advance will be made towards the eradication of this scourge."

Clearly another instance in which we have failed to make our work intelligible.

One Medical Officer conceived the idea of feeding sufferers from the disease on a potage made with rice-husks. The untoward results were naturally disconcerting.

Towards the close of 1910 it was demonstrated that the method of cooking rice by steam under pressure at the District Hospital, Kuala Lumpur, was unsatisfactory, since it converted a harmless into a harmful rice. Yet it was not until towards the close of 1911 that the ordinary process of cooking was substituted.

Dr. Sheppard in the "Malaya Medical Journal" records the finding in 1911 of 55 cases of beri-beri in the Singapore Gaol. Parboiled rice is issued in the gaol, and the rice is cooked by steam under pressure of 40-50 lbs. The reason for the occurrence of these cases is obvious, and an answer is furnished to the question asked by the editor of the "Malaya Medical Journal"—"What about the Singapore prison cases of 1906 occurring on an exclusive diet of parboiled rice?"

It has recently been reported from Siam that the military authorities do not believe that beri-beri is caused by the continuous consumption of polished rice as the staple of diet, they believe the disease to be caused by (1) overcrowding, (2) residence in damp and often flooded surroundings, and (3) lack of nourishment in food.

Unsatisfactory hygienic conditions undoubtedly favour the occurrence of disease, but there is no evidence that they are the causative agents of disease.

Attempts have been made to obtain from Siam a report of the observations upon which the conclusions were based; these have been unsuccessful. The questions

asked could, if the investigations were sound, have been easily answered. The only information obtainable is that there have been improvements in the hygienic conditions, and that improvements in the rations generally have been attended by most satisfactory results. In the absence of evidence to the contrary we are entitled to assume that the dietetic improvements were sufficient; we recognise that if rice-eaters supplement their ration with other and suitable food-stuffs polished rice may be eaten with impunity.

Unfortunately, the question of the etiology of beri-beri is in Siam not purely a medical one. Politics and commerce are factors which cannot be neglected.

Sound criticism and opposition based on facts would be welcome, but opposition springing from ignorance or ulterior motives hinders progress and is a menace to humanity.

At the present time the incidence of beri-beri is less than has been the case in some previous years. But as sure as night will succeed day so surely will the present low incidence of this disease be succeeded by epidemics. It may be that in this country preventive measures cannot be applied. We know that no attempt has been made to apply them and we believe that no attempt will be made.

The cure of Beri-Beri.

Apart from the type of opposition with which I have dealt in the preceding section, there are political and commercial difficulties which hinder the application of preventive measures, so that, even in the most favourable circumstances, cases and epidemics of the disease must continue to occur.

In 1911 there were admitted into the Government hospitals of the Federated Malay States 5,340 cases of beri-beri, and 695 of them died.

In Perak 1,615 cases were admitted to hospital, as compared with 1,622 admitted in 1910. The Acting British Resident states that " Dr. Fox considers that at the rate this disease is diminishing, it will, in a few years' time, become a rare disease." On the evidence submitted it is possible that the disease may become a rare one in about 200 years.

In Negri Sembilan there was an increase both in the number of cases treated and in the percentage of deaths.

These cases are almost wholly confined to the Chinese, of whom, according to the census of 1911, there are 433,244.

No estimate is possible of the cases which did not seek treatment in Government hospitals, but the available information shows that the incidence of this preventable disease was not less than 12·3 per 1,000.

In the Straits Settlements 2,056 deaths from beri-beri occurred in 1911, as against 1,737 in the previous year. The case mortality in the hospitals of the Federated Malay States was 13 per cent., and if it was similar in the Straits Settlements, then 15,830 cases of the disease must have occurred.

It was, therefore, desirable to determine if a remedial agent could be prepared from polishings. As collected in the rice-mills, polishings are mixed with dust and adventitious substances. The mixture does not look palatable either as a gruel or as an emulsion, and we estimate that an adult accustomed to the use of polished rice would require not less than 1·75 ounces of polishings daily; in this form there would be involved the administration of a quantity of substances unnecessary and, perhaps, undesirable for a sufferer from beri-beri. It appeared possible that if the active substances could be separated from the mixture and given in a readily available form, an agent might be obtained which would be of value in the treatment of patients suffering from beri-beri.

It by no means follows that that substance the absence of which from a diet gives rise to disease will induce recovery in sufferers from that disease. We had noted beneficial effects produced on animals suffering from polyneuritis by the administration of extracts from polishings, and all the evidence showed that the production of beri-beri in man and of polyneuritis in fowls was not to be explained by any gross nutritive defect in the ordinary sense of the term, but rather by a deficiency of some substance of whose nature and action we were ignorant.

Believing as we do in the clinical and pathological identity of beri-beri and *polyneuritis gallinarum*, it was decided, in the first instance, to test the value of the remedial agent on fowls suffering from polyneuritis.

Experiments previously recorded have shown that the active substance is soluble in water and in 91 per cent. alcohol.

In alcoholic solution it retains its activity unimpaired for months, and the first test was carried out with an alcoholic extract prepared in the following manner :—

1. Sifted polishings were packed in a percolator, and the fat extracted by means of petroleum ether.
2. The extracted polishings were freed from ether by exposure to the sun.
3. One part of fat-free polishings was macerated and frequently stirred in four parts of 94 per cent. alcohol acidulated with 0·3 per cent. of hydrochloric acid for one week.
4. The mixture was filtered and nearly neutralized with sodium carbonate.
5. The slight precipitate formed on partial neutralization was filtered off and rejected. The filtrate was concentrated under reduced pressure (temperature 60° C.) to a small volume.
6. A little water was added to the residue, and the fat, present in small amount, removed by means of petroleum ether.
7. The fat-free fluid was concentrated nearly to dryness at a temperature not exceeding 60° C., and the residue dissolved in water and alcohol in such proportion that the final product contained 50 per cent. of alcohol, and 1 c.c. of the fluid represented the soluble materials extracted from 10 grammes of fat-free polishings.

Cases of polyneuritis were obtained in the ordinary way by feeding fowls on polished rice, and as soon as an animal showed distinct evidence of the disease it received the remedial agent; throughout the treatment the fowls were fed on the rice the consumption of which had given rise to the disease. As fowls about to develop the disease and fowls with polyneuritis are averse to the consumption of polished rice, it follows that the test was a severe one. Six cases of polyneuritis (Table 1) were treated with the extract.

Case No. 1 received twice daily 0·5 c.c. of the extract. A day or two after treatment was commenced the animal regained the power to take rice in adequate amounts, and ten days later its condition was much improved; seventeen days later it was practically well again. After this the remedy was given once daily, and thirty-seven days after the commencement of the illness the animal had perfectly recovered. It was killed, and the nerves on examination showed no signs of degeneration.

Case No. 2 suffered from a severe attack of the disease, with marked retraction of the head, and was obviously very ill. It was given twice daily 0·5 c.c. of the extract, but was unable to eat; this was accounted for by the severity of the attack, its inability to move, and the retraction of the head. A little rice was therefore pushed into the crop twice daily. Three days later the animal was sufficiently recovered to eat rice voluntarily; seven days later the animal was much better and eating well, but stood with difficulty. The following morning it was found to be very ill and apparently dying, which it did at 2 p.m. Post-mortem nothing of note was observed, but the sciatic nerves showed abundant degeneration.

Case No. 3 received twice daily 0·5 c.c. of the extract for four days, and subsequently 0·5 c.c. once daily. Sixteen days after the onset of the illness the animal had almost recovered, and sixteen days later it had completely recovered. It was then killed, and an examination of the sciatic nerves showed no degeneration.

Case No. 4 received 0·5 c.c. of the remedy once a day. After thirty-six days it had recovered completely, and four days later it was killed; the sciatic nerves were examined and no signs of degeneration were observed.

Case No. 5 received once daily 0·5 c.c. After thirty-six days' treatment it had apparently recovered; four days later it was killed and a few degenerate fibres were found in the sciatic nerves.

Case No. 6 received 0·5 c.c. of the extract once daily, and recovery was complete after forty days.

The next experiment was carried out to test the prophylactic value of this extract. Eight fowls were fed on polished rice and received daily 0·5 c.c. of the extract. The experiment extended over five weeks. The fowls were in perfect health at the conclusion of the period, and their weights throughout were equally satisfactory.

As a control to this experiment eight fowls on white rice received daily five grammes of the same lot of polishings as that from which the extract had been prepared; all of the animals remained healthy.

These experiments demonstrate the value of an extract prepared from polishings as a curative and prophylactic agent.

In the next experiments more thorough exhaustion of the polishings was aimed at; for this purpose one part of fat-free polishings was mixed with four parts of acidulated 94 per cent. alcohol and the mixture boiled for one hour under a reflux condenser. The mixture was then allowed to stand overnight and in the morning filtered; the filtrate was treated in the manner already described, but the final volume was adjusted so that 1 c.c. represented the material dissolved out from five grammes of fat-free polishings, and contained 27 per cent. by volume of alcohol. Thus, while increasing the volume of the prophylactic and curative dose the amount of alcohol was not increased. The lower percentage of alcohol was sufficient for purposes of conservation.

Six cases of polyneuritis (Table II.) were treated with this extract, of which each case was given 1 c.c. daily. The fowls continued to receive the polished rice on which they had developed the disease.

Cases No. 1, 2, 4, and 5 were completely cured in five weeks.

Case No. 6 was cured in 44 days. Case No. 3 suffered from a severe attack and was cured after 48 days' treatment.

The results are, therefore, quite as favourable as those obtained with the first extract. The extracts prepared by these processes contain less of the non-essential material than can be obtained by any of the other processes we have employed.

Experiments are now in progress with a view to determining if the remedy can be prepared by a less expensive process, as by employing weaker alcohols or water. But the less alcohol contained in the menstruum the more saccharine material passes into solution. Whether or not the presence of this substance is disadvantageous we have not yet been able to determine. A watery extract resembling malt extract in appearance and consistence might prove valuable both from the curative and nutritive standpoints.

For those cases of beri-beri with gastric disturbances it would be desirable to employ an extract containing a minimum of non-essential substances.

By either of the methods described an effective liquid-extract can be prepared, of which a dessert-spoonful (ʒ ij) represents the material obtained from two ounces of fat-free polishings, the daily dose for an adult suffering from beri-beri.

Among the many sufferers from the disease there is in all probability a proportion in whom regeneration of the nerves is impossible, but for the others a remedy is furnished which should prove of value in their treatment.

Rapid curative effects must not be anticipated; extensively degenerated nerves require time for their regeneration, but patients placed under favourable conditions and receiving daily after food a dose of this extract will have their prospects of recovery enhanced and their period of invalidism lessened.

On account of the duty charged on alcohol the cost of preparing this remedy in England would be much greater than if the work were done in this country, where alcohol can be obtained free of duty. It is estimated that each dose of the remedy prepared in England would cost not less than sixpence, in this country it could be prepared at a cost of one penny. It is essential that a reliable preparation should be employed. One batch of the remedy prepared in this Institute was found to be inefficient and we were able to determine the cause. It would be a simple matter for any one to throw discredit on the work and to prove the remedy worthless by the use of an unsatisfactory preparation. The standardization of the remedy also presents some difficulties. Rice-polishings are readily available and inexpensive.

For these reasons the remedy should be prepared in this country.

A suitable preparation having been obtained observations must be made on a number of cases suffering from beri-beri. Should satisfactory results be obtained, they could be confirmed by a larger number of cases and its use gradually extended to all sufferers from the disease.

Evidence has been furnished sufficient to justify the work being done; if the remedy be valueless let it be proved so, but let there be no condemnation *ex cathedrâ*, such as we have had to contend with in regard to the prevention of beri-beri.

Leprosy.

Experiments with blood-media.

Experiments have been carried out with a view to the cultivation of the bacillus of leprosy.

In a previous series of experiments, carried out in connection with the cultivation

of the gonococcus, the Koch-Week's bacillus and the diplobacillus of Morax-Axenfeld, it was found that these organisms could be cultivated readily on ordinary + 10 agar which had been mixed with sterile unheated ovarian or ascitic fluids. It was further found that ovarian fluid was more suitable than ascitic fluid. The ovarian fluid was apparently superior because of its higher albumen-content and the presence of blood derivatives. Following up the train of thought suggested by these experiments citrated ox-blood was employed in place of ovarian fluid and found to yield equally luxuriant cultures.

Sterile ox-blood is not readily obtainable in this country because of the method by which cattle are slaughtered and ovarian tumours are rarely met with in the hospitals.

It was therefore decided to employ citrated human blood. Test-tubes each containing 0·0125 grm. of sodium citrate dissolved in 0·5 c.c. of distilled water were sterilized in the autoclave for 20 minutes at 120° C. Under aseptic precautions blood was removed from the median vein and 5 c.c. added to each test-tube containing sodium citrate. Tubes each containing 5 c.c. of 4 per cent. agar, + 10 acid with 6 per cent. glycerine, were melted and cooled to 45° C. To each tube 5 c.c. of citrated blood were added, the contents mixed, sloped and cooled rapidly by means of ice and salt.

The tubes were incubated for two days at 37° C. in order to test their sterility.

The suitability of this meduim for the growth of the tubercle bacillus was tested. Sputum from a case of pulmonary tuberculosis was inoculated into the groin of a guinea-pig. Three weeks later the animal was killed and under aseptic precautions the spleen was removed; it was not apparently tubercular. In stained smears prepared from the spleen tubercle bacilli were not found.

Pieces of the spleen were inoculated into six blood-agar tubes, which were then capped and incubated at 37° C. Three of the tubes were contaminated, but in the other three growth of tubercle bacilli slowly occurred, and by the fourth week the growth was distinct. Subcultures were made on the blood-agar and profuse growths obtained. Only a relatively small number of bacilli were inoculated into the original tubes. In experiments with the lepra bacilli it was designed to inoculate large numbers of organisms because of the possibility, which has been suggested, that many of the bacilli found in the tissues are dead.

Clegg in his experiments claimed to have cultivated the organism in symbiosis with amœbæ. He employed a 1 per cent. alkaline agar. Duval confirmed the accuracy of Clegg's work.

According to Musgrave and Clegg alkaline agar should be prepared " in the same manner as ordinary agar.'' It is recommended to start with an initial alkalinity of 1·5 per cent. phenolphthalein. They state that, after autoclaving and filtering, the final product will have an alkalinity of about 1 per cent.

The medium prepared in the manner described by them, but with 4 per cent. in place of 2 per cent. agar, was titrated with N/10 NaOH and rendered alkaline by means of the calculated amount of N.NaOH. It was then clarified with egg-albumen and filtered. The filtered product was neutral to phenolphthalein.

Another lot of this medium was prepared but clarification with egg-albumen was omitted. The filtered product was not alkaline to phenolphthalein; by titration it was determined that 1000 c.c. required 1·5 c.c. N.NaOH to produce alkalinity to phenolphthalein.

In order to determine the reason for this failure to produce an alkaline agar a series of experiments were carried out. Twenty grammes of powdered agar mixed with one litre of distilled water were dissolved by heating for 20 minutes at 120° C. The solution was practically neutral to phenolphthalein. The volume was adjusted to 1000 c.c. Flasks each containing 100 c.c. of this medium received varying amounts of N.NaOH, and were then heated for 20 minutes at 120° C., afterwards by titration the alkalinity or otherwise was determined.

After autoclaving.

100 c.c. — 4 c.c. N.NaOH — neutral to phenolphthalein.
100 c.c. — 5 c.c. N.NaOH — ,, ,,
100 c.c. — 10 c.c. N.NaOH — 3 c.c. excess of N.NaOH.
100 c.c. — 20 c.c. N.NaOH — 12 c.c. ,, ,,

With 20 c.c. N.NaOH the agar solution did not set on cooling and with 10 c.c. N.NaOH the setting was imperfect.

This experiment was repeated, but in place of autoclaving the mixtures were heated at 100° C. for half an hour on three successive days. A similar result was obtained.

In the next series of experiments $N.Na_2CO_3$ was employed in place of N.NaOH, and the mixtures heated for 20 minutes at 120° C., with the following results :—

After autoclaving.

100 c.c. — 5 c.c. $N.Na_2CO_3$ — 3·9 c.c. excess of $N.Na_2CO_3$.
100 c.c. — 10 c.c. $N.Na_2CO_3$ — 7·8 c.c. excess of $N.Na_2CO_3$.
100 c.c. — 20 c.c. $N.Na_2CO_3$ — 16·3 c.c. excess of $N.Na_2CO_3$.

This experiment was repeated, but in place of autoclaving the mixtures were heated at 100° C. for half an hour on three successive days; similar results were obtained.

In the next series of experiments smaller quantities of $N.Na_2CO_3$ were employed, the mixtures heated for 20 minutes at 120° C., and the following results obtained :—

After autoclaving.

100 c.c. — 1·5 c.c. $N.Na_2CO_3$ — 1·3 c.c. excess of $N.Na_2CO_3$.
100 c.c. — 2 c.c. $N.Na_2CO_3$ — 1·7 c.c. excess of $N.Na_2CO_3$.
100 c.c. — 3 c.c. $N.Na_2CO_3$ — 2·5 c.c. excess of $N.Na_2CO_3$.
100 c.c. — 5 c.c. $N.Na_2CO_3$ — 4 c.c. excess of $N.Na_2CO_3$.

These results were confirmed by other experiments. It was thus apparent that an alkaline agar could be prepared by the use of $N.Na_2CO_3$ and not by the use of N.NaOH, the reagent usually employed. Musgrave and Clegg do not direct attention to this point. If alkalinity of the medium be essential it can only be obtained in the manner indicated. The alkaline agar used in our experiments was prepared by titration with N/10 NaOH and the addition of the calculated amount of $N.Na_2CO_3$; after filtration 6 per cent. of glycerine was added.

Tubes containing 5 c.c. of alkaline agar were melted and cooled to 45° C. To each tube was then added 5 c.c. of citrated blood; after mixing, the tube was sloped and the contents cooled rapidly by means of ice and salt. The sterility of the tubes was tested by incubation at 37° C. for two days.

In the first experiments bacilli were obtained from non-ulcerating nodular cases by disinfecting the skin over the selected nodule, which was then punctured. On applying pressure to the punctured nodule blood appears; this is wiped off and the pressure maintained until a serous fluid is obtained. This fluid, rich in lepra bacilli, was inoculated on the media by means of a platinum loop. The procedure was not successful, most of the tubes being contaminated.

Aspiration of fluid from the nodules was next tried; only small amounts of juice were obtained and the inoculated tubes were all contaminated. Normal saline solution was injected into the nodules, which were then massaged, and afterwards it was attempted to aspirate fluid from the nodule. Only small quantities of fluid were obtained and the inoculated tubes were contaminated.

The following procedure was eventually adopted with excellent results. Nodular cases free from ulceration were invariably selected.

(1) The skin over and around the nodule was painted with tincture of iodine, prepared with 70 per cent. alcohol.
(2) Sterile solution of cocaine was injected into the tissues surrounding the nodule.
(3) A second application of tincture of iodine was made.
(4) When the skin had dried, a horse-shoe shaped incision was made around the nodule and a flap of skin reflected back from the subjacent tissues.
(5) The skin-flap was held back by means of a silk-worm-gut suture, and from the subjacent tissues small pieces were excised: these were inoculated directly on to the media.
(6) When a sufficient amount of tissue had been excised the skin-flap was returned and sutured. Healing by first intention can invariably be obtained.

In a number of experiments conducted recently nodules on the ear have been selected. In these cases a simple incision has been made and the wound made to gape by means of a suture inserted on either side of the incision. From the depth of the wound pieces of tissue were excised.

In every case a piece of the tissue was excised for microscopical examination. Abundance of lepra bacilli was invariably found. No possible objection can therefore be raised on the ground that an insufficient number of bacilli were inoculated.

The material was obtained from 13 non-ulcerating nodular cases of leprosy. From any one nodule the minimum number of tubes inoculated was four and the maximum number 13. In all 75 inoculations were made on + 10 blood-glycerine agar and 54 inoculations on alkaline blood-glycerine agar. Every tube received a piece of tissue on an average equal in size to that of a rice-grain and swarming with lepra bacilli.

Contaminated tubes can be detected after incubating for a day or two. At first contaminations were not infrequent, but now with greater experience this is exceptional, and recently 21 cultures were prepared from two patients and not a single tube was contaminated.

As regards the contaminations, staphylococci were most frequently met with. Non-acid-fast bacilli and streptothrices have also been observed; with films prepared from these it is easily possible to follow the descriptions given and figures illustrated by various writers. Clumps of acid-fast bacilli can be seen in the midst of non-acid-fast bacilli or streptothrices. On subculture on any media the contaminating organisms proliferate and the acid-fast bacilli disappear; this is only what is to be expected. The contaminating organisms have no genetic relationship with the lepra bacillus.

Twelve tubes were inoculated with tissue excised from one nodule. Each tube must have received a piece of tissue containing certainly not less than a million bacilli. On incubation at 37° C., one tube showed, after a few days, a well-marked growth over and around the piece of tissue; the growth was brownish, dry, and wrinkled. It consisted of a non-acid-fast filamentous organism. On none of the other tubes did anything develop. Admitting that in a leprous nodule most of the bacilli are dead, it is not fair or reasonable to assume that out of the many millions of bacilli inoculated, only in this one tube was there a bacillus alive and capable of proliferating.

The inoculated tubes were incubated at 37° C.

(1) Aerobically under the following conditions:—
- (*a*) In the ordinary way;
- (*b*) In moist chambers;
- (*c*) With sterile water added from time to time to replace moisture lost by evaporation;
- (*d*) In rubber-capped tubes.

(2) Anaerobically.

The maximum period of anaerobic cultivation was one month; by that time the medium has become dried and shrivelled. There was no proliferation of the lepra bacilli.

The maximum period of aerobic cultivation is now five months. From no tube inoculated aerobically has a culture of the lepra bacillus been obtained; the organisms persist but do not proliferate. They retain their form and their acid-fastness.

Experiments with Rost's medium.

For his initial cultures this investigator employs a medium of the following composition:—

Distilled volatile alkaloid of rotten fish ...	250 c.c.
Weak lemco broth without salt or peptone ...	250 c.c.
Milk	50 c.c.

Burmese preserved fish was not available. Williams has shown that distilled water may be substituted for the fish-distillate. It was not, therefore, considered necessary to obtain this kind of fish and to dismantle an autoclave for the purpose of preparing the distillate. As, in addition, the medium after preparation is directed to be autoclaved, it is difficult to see that much, if any, of this volatile alkaloid can remain in the medium.

Rost's medium was prepared in accordance with Williams's modification.

Six tubes were inoculated with leprous tissue obtained from one patient and six tubes were inoculated with tissue from another patient. The tubes were incubated at 37° C. None of them were contaminated, and films prepared from time to time did not show that the bacilli had proliferated. After incubation for two and a half-months most of the media had evaporated, and the pieces of tissue were transferred to fresh tubes.

A month later films were prepared from all the tubes, but in no single instance was there evidence of proliferation. The organisms were acid-fast and their appearance corresponded in every way with the acid-fast bacilli seen in films prepared from a fresh leprous nodule. Bizarre forms were never seen.

Experiments with Williams's medium.

This investigator claims to have obtained initial cultures of the lepra bacillus on ordinary nutrient broth and on potato broth.

He gives no special directions for the preparation of potato broth; it was therefore prepared in the ordinary way. Pieces of tissue were obtained in the manner already described, and six tubes of potato broth were inoculated. From another patient pieces of tissue were obtained and six tubes inoculated.

The tissue from both cases swarmed with acid-fast bacilli. The tubes were incubated, as recommended by Williams, at 37° C. The cultures were examined from time to time but proliferation of bacilli was never observed.

After incubating for two and a half months the media had almost entirely evaporated. The pieces of tissue were transferred to fresh tubes. A month later this experiment was ended. The tubes were well shaken and films prepared from the culture fluid. The films were stained and examined; only occasionally were bacilli met with, and these were invariably acid-fast.

Films were prepared from the inoculated pieces of tissue. The cells had entirely disappeared. Bacilli, invariably acid-fast, were present in great abundance. They invariably showed the ordinary form of the lepra bacillus, bizarre forms were never seen, and there was nothing to indicate that the bacilli were more numerous than in the tissue originally inoculated; in short, there was no evidence of proliferation.

Experiments with Bayon's medium.

This investigator has employed various media, among others placental agar prepared according to the manner described by Kedrowsky.

Bayon in his published works does not state the method of preparing placental agar, but in reply to a communication addressed to him we were furnished with the necessary particulars, and the medium was prepared in accordance with his directions.

After 48 hours' incubation at 37° C. to test the sterility of the tubes, 20 were inoculated from one case of leprosy and 15 from another.

These tubes have now been incubated for over five weeks. Not one of them shows contamination, and not one of them shows a culture of the lepra bacillus.

Experiments with other media.

Clegg claims to have grown the bacillus in symbiosis with amœbæ. Duval confirmed the accuracy of this claim and showed that symbiosis with amœbæ was not essential, but that symbiosis with organisms capable of decomposing protein was. Later he showed that symbiosis with other bacteria could be dispensed with provided that the lepra bacilli were sown on a medium containing amino-acids.

Of the amino-acids tryptophan and cystein are said to be the important ones. Casein was not available, and it was attempted to prepare tryptophan from condensed milk, but the quantities obtained were insufficient for experimental purposes. Later, Duval and Wellman stated that a trypsinized egg-medium was quite as satisfactory as one to which amino-acids had been added.

Tubes of Dorset's egg medium were prepared and inoculated with pieces of leprous tissue. The surface of the medium was then covered with a solution of trypsin. Duval at first laid stress on the importance of incubation at 32° C., but later he appears to cultivate the organism quite readily at 37° C. Twenty-two tubes in all were inoculated, half of them were incubated at 32° C. and the other half at 37° C.

After some days the media in the tubes had been digested into a slushy mass. No evidence was obtained from any of the tubes that proliferation of the bacilli had occurred.

Again following Duval, egg-albumen in Petri dishes was inspissated for three hours at 70° C., and each plate then received a piece of leprous tissue. The surface of the medium was covered with a solution of trypsin and the plates incubated at 37° C. Most of them became contaminated, but in one or two uncontaminated plates there is no evidence of proliferation.

Still later, Duval and Wellman, following Kedrowsky, have recommended the use of placental agar.

This medium was prepared, and ten days ago thirty tubes of this placental agar were inoculated with leprous tissue from two lepers, and all but two are uncontaminated.

The leper asylum is situated within half a mile of the Institute; it contains more than 250 patients. Selected cases came willingly to the Institute, so that it was easily possible to transfer the leprous tissue direct from the patient to the culture media. The conditions are more favourable than those under which some investigators have had to work; thus Duval obtained his material from a leper asylum sixty miles distant from the laboratory.

From ulcerated cases of the disease it is possible to grow all sorts of organisms, and equally so from tissues removed post-mortem. For these reasons the tissue was invariably obtained from non-ulcerated cases in the manner already described.

Twenty-two patients have thus been dealt with, and two hundred and forty-six inoculations made on various culture media. In no single instance has a culture of the lepra bacillus been obtained. By certain processes of staining and fixing it is possible to find in films that the non-acid-fast contaminators, streptothrices and bacilli approach in slenderness the lepra bacilli, but on further investigation it has been found that they have no genetic relationship. Cultures obtained after incubation for three or four days are invariably those of contaminators; those obtained after prolonged incubation are contaminators which either have been introduced accidentally or have grown through the cotton-wool plugs.

There are difficulties in inducing strongly parasitic organisms to adapt themselves to saprothytic conditions. When investigators overcome these difficulties it is customary for them to describe their methods in detail so that the work can be repeated by any worker possessed of the necessary facilities and skill. The claims made by the original investigator are tenable, provided that their accuracy is confirmed independently and the results obtained are uniformly consistent. But the results obtained by recent workers on leprosy are not consistent. The number and variety of organisms described as having been cultivated from the lepra bacillus are wonderful; they are certainly pleomorphic. From mustard-seed it is impossible to grow on one occasion a fir-tree and on another occasion a rose, unless the mustard-seed has been mixed with the seeds of those other plants.

Epidemic Conjunctivitis.

A severe epidemic of purulent ophthalmia occurred among the inmates of an orphanage in Kuala Lumpur.

On the occasion of our first visit, twenty children, including four infants, were shown to us as suffering from the disease. On further investigation, all the children, twenty-four in number, and one sister were found to be affected with conjunctivitis.

The majority of the patients, including the sister, were obviously suffering from gonorrhœal ophthalmia. From each case films were prepared. Cultures were only prepared from a few of the cases, because at the time a sufficient amount of suitable media was not available. On examination the following results were obtained :—

1 sister	...	gonococcus.
9 children	...	gonococcus.
9 children	...	gonococcus and Koch-Week's bacillus.
6 children	...	Koch-Week's bacillus.

I have not previously met with mixed infections caused by the gonococcus and the Koch-Week's bacillus. This statement is based on the experience gained by the examination of over 1,000 cases of conjunctivitis, 820 being the number in a consecutive series examined during one year. The commonest form of conjunctivitis in infants was found to be that due to the Koch-Week's bacillus, and the next in order of frequency is that caused by the gonococcus.

I can find no records in the literature of mixed infections caused by these organisms; the findings in this epidemic are, therefore, of some interest.

So far as infection with the gonococcus is concerned the origin of the epidemic was easily traced. Twenty-four days previous to our first visit a new-born child was admitted suffering from "bad eyes." This infant died fifteen days after admission

Soon after the admission of the first case two of the other inmates developed ophthalmia and gradually the disease spread.

It is impossible to state if the first case admitted was a mixed infection, or if at the time of admission conjunctivitis due to the Koch-Week's bacillus was present among the inmates, but the investigation reveals an unsatisfactory state of affairs. The good work done by the orphanage is handicapped by the lack of medical supervision; those in charge of the institution were ignorant of the serious nature of the epidemic. In the case of the sister the disease was fortunately confined to one eye, but the vision of that eye has been destroyed, and in the case of the other inmates some of them have had their vision permanently impaired.

I have on previous occasions investigated two epidemics of gonorrhœal ophthalmia in adults; in neither of these was the condition recognised by those responsible for the diagnosis.

Blackwater Fever.

Dr. Fletcher has continued his researches on this subject, and furnishes the following report:—

Of recent years, concurrently with a large influx of Europeans and of Indian labourers, the opening up of considerable areas of land for rubber planting and a great increase of malaria throughout the country, there has been a number of cases of blackwater fever, a disease hitherto almost unknown in the Federated Malay States. During the past six months material was received on seven occasions for confirmation of the diagnosis of blackwater fever. The results of the examinations were as follows:—

A.—Urine only, from the case of a European in Kuala Lumpur, who had been suffering from subtertian malaria. Examination showed the presence of hæmoglobin granular cells and granular casts of a characteristic nature: the so-called "hæmoglobin casts."

B.—Urine only, from the case of a European in Seremban, who had been suffering from subtertian malaria. Examination of the urine showed the presence of hæmoglobin and casts as in A.

C.—Urine only of a Tamil in Tanjong Malim. The dark colour of the urine in this case was due to bile pigments, there was no trace of blood.

D.—Urine only, from the case of a Tamil in Tanjong Malim Hospital. In this case also the colour of the urine was produced by bile pigments.

E.—Urine and blood-smears of a European living at Klang. In this case the urine was ordinary high-coloured, febrile urine, and the patient was suffering from benign tertian malaria, the parasites of which were found in large numbers in the blood-smear.

F.—Blood-smears, liver, spleen and kidney, from a Chinaman who died in Taiping Hospital. This man had been admitted suffering from subtertian malaria, and received thirty grains of quinine every day. He had no fever after his second day in hospital. Anchylostome eggs were found in the fæces and forty grains of β-napththol were administered on the fourth day. On the following day he vomited several times and his temperature rose to 100° F. During the night he passed "dark blood-stained urine, containing no blood cells," and died at three o'clock the next afternoon. No malarial parasites were found in the blood or spleen smears examined at the Institute, nor were the intracellular bodies seen which have been described by Leishman as occurring in blackwater fever. The large mononuclear leucocytes constituted 12·6 per cent. of the white blood cells. In sections of the viscera there was abundance of recent and old malarial pigment. In the liver and spleen there were no changes beyond cloudy swelling in the former and a general hypertrophy in the latter. The kidney showed the scars of old attacks of nephritis; it was also the seat of recent and acute pathological changes. In many of the malpighian tufts there was an extensive exudate within Bowman's capsule; the epithelium of the convoluted tubules was necrotic and their lumina contained a catarrhal exudate. The exudate in Bowman's capsule and in the proximal convoluted tubules gave the Prussian blue reaction of free iron and contained small fat-droplets. The epithelium of the collecting tubules was normal; the characteristic hæmoglobin casts were not present and there was no blocking of Henle's loops.

G.—Urine and viscera of a Chinaman from the District Hospital, Kuala Lumpur. This patient was admitted with profuse epistaxis and passing black urine. No malarial parasites were found in his blood. He died on the day of his admission

to hospital. The urine contained hæmoglobin, granular cells, amorphous debris, hæmoglobin casts and many more erythrocytes than are seen in typical blackwater fever. From the stomach to the rectum the intestines were full of clotted blood, and the small intestines were plum-coloured.

The spleen and the mesenteric glands were enlarged, soft and purple; some of the latter were as large and as dark as damsons; both the glands and the spleen contained great numbers of large phagocytic cells, measuring from eighteen to twenty-one microns and containing several engulfed erythrocytes, sometimes as many as nine being enclosed within one cell.

The parenchyma of the liver was in a condition of acute necrosis; the trabeculæ were broken up, and the liver cells, many of them containing Daniel's golden pigment, were lying singly and in groups amid a mass of debris, small cells and large phagocytes.

There was a hæmorrhage into the pelvis of the right kidney, but none in the left. Microscopical examination showed an acute necrosis of the epithelial lining of the convoluted tubules and some catarrh of the collecting tubes. The glomeruli were, for the most part, normal; there were no hæmoglobin casts and no blocking of Henle's loops.

The blood, the spleen, and the mesenteric glands contained numbers of gram-negative bacilli resembling *B. pestis.* Some of the blood was rubbed on to the scarified abdomen of a guinea-pig, which remained healthy. When it was killed and examined on the tenth day there were no signs of plague.

No malarial parasites were found in this patient's blood, and there was little or no malarial pigment in the liver and spleen.

A critical survey of these seven cases, which had been clinically diagnosed as blackwater fever, tends to lead one to the conclusion that in not more than two was this diagnosis confirmed on further examination. One knows, with certainty, that hæmoglobinuria occurred in three cases, the first two and the last; it may also have occurred in case F. Cases A and B were probably blackwater fever. C, D, and E were not. The condition of the kidney in case F was unlike that seen in blackwater fever; there may have been a toxic hæmoglobinuria due to the administration of β-naphthol, the patient being in a debilitated condition, with damaged kidneys; or, on the other hand, the black colour of the urine, on which the clinical diagnosis was based, may have been caused by the presence of pyrocatechin or hydroquinone, produced by the dose of β-naphthol which the patient had received.

The last case, G, was one of septicæmia. The patient lived in a district where there was an epizootic of rat plague and where there had been four cases of bubonic plague. He died after an acute illness lasting twenty-six hours, and at the post-mortem examination, sixteen hours after death, bacilli resembling *B. pestis* were found in his blood, spleen, and glands. A guinea-pig inoculated cutaneously with the blood of this patient remained well. It is therefore uncertain that he died of plague; but the post-mortem findings negative the diagnosis of blackwater fever.

The dark urine of blackwater fever is so terrifying, the disease appears with such dramatic suddenness, and is so often fatal, that, though the disease is uncommon, there is probably hardly a single European in the country who does not know of it and dread it. In a disease such as this, one symptom, by its alarming features, so overshadows all the rest that the diagnosis is generally based on the appearance of this striking symptom, the black urine. It is, therefore, not surprising that many of the cases returned as blackwater fever have, in reality, never suffered from that disease. In three of the above cases in which the urine was sent for examination, the dark colour was not due to hæmoglobin, and in at least one of the cases in which hæmoglobin was present it was not due to blackwater fever. Thus it will be seen that the errors in the diagnosis of blackwater fever fall into two classes; first, those cases in which there is no hæmoglobinuria but a blackness of the urine due to bile, drugs, or other causes; and secondly, cases where there is hæmoglobinuria, but where it is due to causes other than blackwater fever.

Widal Reaction.

Forty-seven specimens of sera were examined for the presence of typhoid agglutinins. Sixteen of them gave a positive reaction. One serum which gave a negative reaction at the end of the first week of illness was tested again during the third week; it then agglutinated *B. typhosus* in a dilution of 1/40 and *B. paratyphosus A.* in a dilution of 1/360.

Wasserman Reaction.

Noguchi's modification of the Wasserman reaction was applied in thirty-two cases with the following results :—

Primary Syphilis.—Two cases, both weakly positive.
Secondary Syphilis.—Six cases, four of which were positive and two weakly positive.
Tertiary Syphilis.—Eight cases, of which four were positive, two weakly positive, and two negative.
Latent and Cured Syphilis.—Seven cases, of which one was weakly positive and six negative.
Doubtful Cases.—Four, all negative.
Lepers.—Six, all negative.

Rabies.

The brains of seven dogs, suspected to be cases of rabies, were examined for Negri's bodies, which were found in five of them. These five cases occurred in Negri Sembilan, at places so far apart as Seremban, Jelebu, and Gemas, indicating that the disease is spread over a large area.

Cysticercus Cellulosæ.

Portions of two pigs' carcases infected with *Cysticercus cellulosæ* were sent from the State of Negri Sembilan by the Veterinary Surgeon. One of these pigs had been imported from Saigon and the other from the Island of Balik. This cysticercus has not been met with hitherto in this country; though the Chinese eat largely of pork, they cook it thoroughly, and *Tænia solium* is very uncommon.

Bacteriological Examination of Waters.

Water from various sources was examined before and after filtration. An examination of the water for Kuala Lumpur from the new source of supply was made in June. The rainfall is not measured at the intake or in the catchment area, and the records made in Kuala Lumpur are no guide to the rainfall in the surrounding hills. Rainstorms in this country are so localised and limited in their distribution that a heavy fall may take place over a certain area, while a couple of miles away there is none at all. It is probable that the height of the rivers is the best available indication of the amount of rain in the catchment area.

In June, when the examination of the new water supply was made, the rivers were moderately high. The water, before filtration, contained 204 organisms in 1 c.c.; fæcal organisms were present in 0·1 c.c. and upwards. A sample taken after filtration contained 44 organisms in 1 c.c., and fæcal organisms in 1 c.c. and upwards.

In the following month, July, the town water supply became turbid and muddy-looking owing to illicit tin-mining operations in the catchment area. A detailed examination of the fæcal organisms found in a sample drawn from one of the laboratory taps, on a day when the rivers were high, showed the presence of *B. oxytocus perniciosus* together with *B. cloacæ* and *B. grunthal*; the first, according to Clemesha, being evidence of recent contamination.

An examination made at the end of July, when the rivers were low, showed a larger proportion of the more resistent organisms, *B. coli mutabilis* (Massini), *B. cloacæ*, number 75 and number 73 (MacConkey), together with a smaller number of organisms indicating moderately recent pollution, numbers 67 and 68 (MacConkey).

An examination was made again in September, several weeks after the clandestine mining operations had been stopped and the trespassers expelled from the catchment area; at this time the rivers were very low indeed, and on this occasion *B. cloacæ* and *B. neapolitanus* were the only organisms present which fermented lactose in bile-salt media.

Cholera.

In April and June material from several cases showing choleraic symptoms was received for examination. In two instances the suspicions of the Medical Officers were confirmed by the result of the bacteriological examination. The first case, which occurred in April, was a Tamil coolie employed on a rubber estate in Selangor; the second was a clerk in Government service, who was taken ill after a visit to Seremban in June.

Plague.

In April the bacteriological examination of the bubo of a patient who had died at the General Hospital, Kuala Lumpur, showed that he had been suffering from plague. On the following day the *Bacillus pestis* was found in the primary bubo of a patient at the District Hospital. Both of these cases, and two others which occurred in May and June, came from a small hamlet, about equidistant from Kuala Lumpur and the town of Ampang, five miles away.

An examination of the rats caught in this place showed that they were suffering from epizootic plague. For some three months, between April 16th and July 10th, the Sanitary Officer forwarded to the Institute rats trapped or picked up in the village where these plague-cases had occurred. Of seventy-two rats which were examined, nine were found to be infected with plague. Only four of the rats were brought to the Institute alive and, as fleas generally quit their host so soon as it dies, very few of these parasites were found upon the rats examined; all of them were of the species *Lœmopsylla cheopis* (Rothschild). Among the rats examined were six examples of *Mus musculus* (Linn) and two shrews (*Pachyura murina* Linn).

The remainder were all of the species *Mus rattus*. Three of these belonged to the small variety, *Mus concolor* (Blyth), and the rest to the variety *Mus griseiventer* (Bonhote), the common Malay house-rat. The three examples of *Mus concolor* were brought from the same house on the same day and had all died of plague. It is said that this variety of *Mus rattus*, which occurs only eastward of India proper, is the common house-rat in Yunnan, a notorious home of plague.

Chemistry.

The total number of analyses performed during the six months under consideration was 486. They are grouped as follows :—

(1) Waters	80
(2) Milks	208
(3) Chandu and chandu dross	55
(4) Morphine and cocaine	21
(5) Counterfeit coins	8
(6) Articles examined for blood-stains	29
(7) Articles examined for poisons	39
(8) Liquors	30
(9) Miscellaneous	14

The notable features are a large increase in the number of water samples analysed compared with the previous half year, the large decrease in the number of counterfeit coins and exhibits examined for morphine.

The systematic examination of several town water supplies was continued. The other samples analysed were from estate and railway supplies. Two samples were received from Gunong Tahan, near the site proposed for the new hill station. They were found to be somewhat peaty, containing a considerable proportion of vegetable matter in solution, but otherwise of satisfactory purity.

Of the 208 samples of milk anlysed 28 were found to be adulterated with water, and in some cases as much as 30 per cent. of water had been added.

Only a few samples of chandu dross were examined, as it has been found impossible to say whether a dross is derived entirely from Government chandu or not. A large number of the substances examined for chandu were pills, some of which were called anti-opium pills. Most of them were found to contain chandu.

Nineteen articles were examined for morphine, and eight gave positive results. Two articles were examined for cocaine and both were positive.

Eight coins were analysed, five contained the legal proportion of silver and three slightly less.

Of the articles examined for blood stains, 13 gave positive results and 16 negative.

Among the articles examined for poisons were 12 stomach-contents, of which four gave positive results (three arsenic and one opium). Among the other articles, poisons were found in six cases (potassium cyanide, datura seeds, and arsenic), and the number of negative results was 21.

Very few determinations of spirit strength were made as this work is now done mainly in the Department of Trade and Customs. Ten complete analyses of spirits

were made, and some samples of toddy and Chinese medicated wine were also analysed.

The miscellaneous analyses included an iron ore, a crystalline mineral (found to be a silicate of iron), a shale-oil, a liquid fuel, which it was proposed to use on locomotives, some tin-ore slags, determinations of sugar in some samples of urine, and the determination of arsenic and sulphur in the flue gases of a furnace used for roasting pyritical tin ore.

A considerable amount of work was done in connection with the extraction of the neuritis-preventing substance contained in rice-polishings.

H. FRASER,
Director, Institute for Medical Research,
Federated Malay States.

TABLE I.—EXTRACT WITH ACIDULATED COLD 94 PER CENT. ALCOHOL.

No.	Description.	Weight at commencement of treatment.	1st week.	2nd week.	3rd week.	4th week.	5th week.	6th week.	Remarks.
1	Spotted cock ...	1,060	1,040	1,075	1,120	1,100	1,120	—	Cured after 37 days.
2	White and black spotted cock.	970	850	—	—	—	—	—	Died 11 days after onset of disease.
3	Red cock	940	1,025	1,035	1,067	1,080	—	—	Cured after 32 days.
4	White and black spotted cock.	1,365	1,470	1,480	1,470	1,460	1,450	1,565	Cured after 36 days.
5	Black and red cock	1,145	1,205	1,215	1,200	1,190	1,180	1,200	Cured after 36 days.
6	White and black cock	1,260	1,315	1,380	1,415	1,420	1,445	1,455	Cured after 40 days.

TABLE II.—WITH 94 PER CENT. ALCOHOL HOT EXTRACTION.

No.	Description.	Weight at commencement of treatment.	1st week.	2nd week.	3rd week.	4th week.	5th week.	6th week.	Remarks.
1	Yellow cock ...	1,200	1,225	1,300	1,315	1,350	1,425	—	Cured after 34 days.
2	Brown and black cock	845	920	945	890	910	920	—	Cured after 35 days.
3	Yellow cock ...	670	670	680	710	700	730	700	Cured after 48 days.
4	White and black cock	840	885	880	870	870	870	—	Cured after 31 days.
5	Black and white spotted cock.	840	885	895	915	845	780	—	Cured after 30 days.
6	Yellow cock ...	990	980	1,025	1,005	995	1,070	1,125	Cured after 44 days.

No. 7.

WINDWARD ISLANDS (ST. LUCIA).

LABORATORY REPORT FOR THE SIX MONTHS ENDED MARCH 31ST, 1912.

(Received in Colonial Office, 23 July, 1912.)

I have the honour to submit for the information of His Excellency the Governor and for transmission to the Right Honourable the Secretary of State, the laboratory report for the six months ended March 31st, 1912.

During the last six months the usual amount of laboratory routine has proceeded satisfactorily

The distribution of "Millions" fish and quinine, which was employed more on the leeward than on the windward side of the island, has been more actively carried out in the valleys and villages of the windward coast.

Research work has been continued but, on account of an increase in my duties, this has recently been suspended for the present.

My efforts were confined to these subjects :—

(1) The relation of the causal organism of leprosy to the stomachs of insects.
(2) The breeding-places and diseases of anopheline larvæ.
(3) Ankylostomiasis in domestic animals.

1. On two occasions I have been told by patients suffering from leprosy, that at nights they were an attraction to cockroaches, which, they stated, gnawed their scabs and ulcers.

I visited the hut of a leper who was in a very ulcerated condition and from the bed sack I caught ten cockroaches from among a larger number. I obtained another ten from other parts of the dwelling. The next day smears were taken from the stomach of these insects and stained for acid-fast bacilli; in all the first ten, bacilli morphologically indistinguishable from the Hansen's bacillus were seen in every case, in several cases in very large numbers. In the smears taken from the second ten cockroaches, the bacilli were present in only three of them.

Twenty cockroaches were obtained from huts which were not inhabited by lepers, and their stomachs and intestines similarly examined; in two cases only were acid-fast bacilli seen, but these were not morphologically similar to Hansen's bacillus, being thicker, and square at their ends.

This suggested a further examination of the stomachs of cockroaches and other insects which had fed on leprotic discharges.

For this purpose cockroaches, and a variety of flies, including musca domestica, oscinis pallipes, and several sarcophaga, were placed in separate cages and were fed upon the nasal and ulcer discharges of lepers; these insects had previously been starved for from eight to twelve hours. At the end of twenty-four hours they were removed to other cages and fed on sugar and water, meat and fruit juices.

In the case of the flies, they all died out by the fourth day; the majority of those whose stomach contents were examined exhibited the organism of leprosy.

With the cockroaches it was different, specimens were examined for ten days after the original engorgement of leprotic material. The results were not uniform, but in the majority of cases numerous acid-fast bacilli were seen. In some cases two points were very noticeable:—

(1) That often the smear appeared to show the bacilli more numerous than in the original leprotic discharge.
(2) That, though in nine cases out of ten there was a progressive decrease in the number of organisms in the smear proportionate with the number of days after the leprotic material had been taken, occasionally a smear would show an apparent increase.

It had been my intention to repeat these experiments on a larger scale and to keep closer times and to form a more accurate estimation of the acid-fast organisms. But as this entails a large amount of constant work I am unable at the present time to continue it.

It was indicated that:—

(1) Either the stomach walls of insects are occasionally susceptible to the growth of Hansen's bacilli,—or
(2) that the bacilli possess a curious power of adherence to the stomach wall, and possessing a resistance to the stomach juices all else is digested while they alone remain.

As a similar condition appears to take place in more than one tribe of insects (including bedbugs) I am strongly of the opinion that the latter is the true explanation. It is hardly likely that a condition in which organisms are often spread broadcast by the million, should require further cultivation, especially as there is no reason to believe that there is any life-cycle gone through by that organism in connection with insects.

The curious adhesive powers of the organism to mucous surfaces, may account for the initial lesion so frequently being in the nasal cavities.

2. I have now collected a large number of notes on the breeding-places of anophelines of the genus Nyssorhynchus, on their natural enemies, and the diseases of their larvæ. These notes show :—

(1) That non-permanent grassy meadow pools and swamps are their principal breeding-places in wet seasons.
(2) That the edges and cul-de-sacs of shrinking permanent pools and rivers are their principal breeding-places in dry seasons.
(3) That in a large number of breeding places they are quickly destroyed by their natural enemies or disease.
(4) Their diseases are due to protozoa and fungi.
(5) That much valuable time and much money can be wasted by starting anti-malarial work, if a thorough study of anopheline breeding-grounds has not previously been carried out over an extended period.

3. Ankylostomiasis is undoubtedly the most important disease of domestic animals in this island, and, as I have pointed out in a previous report, causes the death of a large number of sheep, a poor and emaciated condition in numerous horses, and the loss of many dogs. Until owners recognise a number of important points, the present condition of the majority of these animals is not likely to improve.

(*a*) The *diagnosis* of the condition is easy, the ova (eggs) of the worms being easily recognised under the lower powers of the microscope. Dispensary students and other youths are quickly taught to examine dejecta for these ova. (At the present time an increasing number of specimens are being sent for examination to Dr. King and myself.)

(*b*) The *treatment* consists in administering large doses of thymol, beta-naphthol, or eucalyptol to the fasting animal and following the drug by a purge such as Epsom Salts. I would recommend the following doses of thymol or beta-naphthol :—

Ponies.—Three doses of $1\frac{1}{2}$ drachms each administered at the hours of 6, 7, and 8 a.m., respectively.
Sheep.—Three doses of 1 drachm each—ditto above.
Dogs.—Three doses of 12 grains each—ditto above.

This treatment shall be repeated at the end of ten days and again at a similar interval, if necessary.

(*c*) *Prevention.*—The life history of the worm is of importance from the point of view of prevention.

The egg.
(1) The female worm, which lives in and sucks blood from the small intestine, lays a vast number of eggs which escape with the dejecta.

The young larva in the earth.
(2) These eggs falling on *damp* earth, quickly hatch into a minute worm which devours a certain amount of organic matter and increases in size.

The developing larva in the body.
(3) These larvæ are still invisible to the naked eye, and can increase no further until they gain access to the animal's body. They get on to the nose or on to the mucous surface of the mouth of grazing horses and sheep or may be even on to their legs or bodies. They now penetrate into the tissues; here they increase in size and after a complicated course through the circulation and lungs, they are probably coughed up and swallowed.

The adult worm.
(4) Arriving at the intestine they complete their development by becoming adult worms male and female. These are $\frac{1}{3}$ to more than $\frac{1}{2}$ an inch in length according to the species.

From this development it follows that we should try to tackle the creature at its different stages of existence, when it is an ova, a larva, or an adult.

In my report for the six months ended September 30th, 1910, I described experiments which are here of importance,—namely that sea water and certain disinfectants destroyed the ova and larvæ; that they are killed by drying, and that the heat of surfaces exposed to the direct rays of the sun quickly destroys them. The mean solar radiation of the tropics is far above the point at which they can be destroyed.

From this I would recommend for preventive measures :—

(1) That stalls and kennels are kept as dry as possible, and frequently thrown open to admit the sun.

(2) That sheep are allowed to remain at night under well-drained and dry sheds.

(3) Stalls, kennels, and sheds should be periodically washed out with sea water, or with a solution of " Cyllin " of strength 1-1000.

(4) Proper water troughs should be supplied. One of the greatest sources of infection is a muddy drinking pool. The mud around a pool often teems with ankylostome larvæ, ever ready to infect the animals as they come in to drink.

(5) The difficulty of keeping a flock of sheep is notorious and these worms are the reason. Every sheep added to a small flock, increases the chances of each individual to infection.

If an energetic breeder of cattle were desirous of obtaining a large and healthy flock, it could be done by attention to the following :—

(*a*) The pasture should be freed of bush and kept short by cutlassing or burning, and allowed to lie under the action of the sun's rays throughout a dry season, no cattle of any sort being kept in it. (Better still would be an entirely new pasture.)

(*b*) No sheep should be placed in this pasture until a thorough examination of their dejecta has shown them to be free of ankylostomes. As few sheep exist in this island, which do not harbour a few of these parasites, sheep should be obtained from elsewhere, or local sheep should be kept in dry and disinfected pens and subjected to prolonged treatment until they are freed of the worms. This treatment would require at least six months before the sheep could be allowed into the pasture.

Once a pasture and sheep were free of this pest, they would naturally remain free, unless new infected individuals were added to the flock.

Sheep may be kept relatively free if they are herded to different parts of an estate each day, the more open and less shady parts being chosen.

Therefore methods for the eradication of this nematode consist in thorough treatment of the infected, to destroy the adult worm, and the action of drying and the sun's rays to destroy the ova and larvæ.

LUCIUS NICHOLLS.

APPENDIX VII.

Report* by Captain T. J. Potter, R.A.M.C., on Vomiting Sickness in Jamaica.

From CAPTAIN T. J. POTTER, R.A.M.C., to THE RIGHT HONOURABLE THE SECRETARY OF STATE FOR THE COLONIES.

SIR, 86, Belgrave Road, S.W., 21 December, 1911.

I HAVE the honour to forward herewith report on "Vomiting Sickness" in Jamaica.

I have, &c.,
T. J. POTTER,
Captain, R.A.M.C.

VOMITING SICKNESS IN JAMAICA.

For many years the question of "Vomiting Sickness" has been discussed by the Medical Profession in Jamaica. The term Vomiting Sickness would appear to have been in use in the Island for a long time, as enquiry amongst the country people invariably elicited the answer, "they always remembered it." The term, as used popularly, appears, however, to be applied to any disease in which vomiting is a prominent symptom. Of later years the term has been adopted by medical men and among them the name would appear to be confined to a disease of which the most prominent symptom is vomiting, the incidence of which is *mainly* amongst children, and which is attended by a high case mortality, with a rapidly fatal termination.

One of the first instances in which the term vomiting is used officially, is in the Departmental Report, 1894-5, when vomiting and collapse are mentioned as a cause of death in a number of cases occurring in a group.

Many explanations of the disease have been given, some authorities maintaining that it is a separate clinical entity, others that it is but a symptom of one or many diseases. Some regard it as cerebro-spinal meningitis, others have described it as capillary bronchitis, whilst others again have called it gastro-enteritis, gastritis, ackee poisoning, cassava poisoning, ptomaine poisoning, worms, &c. How loosely the term is used may be seen from the report of the District Medical Officer, Lionel-town, Appendix A. (page 10).

At first (Appendix A.) referred to as cerebro-spinal meningitis, it later became customary to class the majority of cases as gastro-enteritis, but from 1903 and 1904 onwards the disease is referred to as the "Vomiting Sickness" or "Group of diseases popularly included in that term." With regard to the diagnosis of gastro-enteritis, it may be stated that, whilst the great majority of post-mortem descriptions refer to a gastritis, enteritis is never mentioned; it is also to be noted that in other countries gastro-enteritis is not a very fatal disease, whereas in Jamaica the cases which have been included in this term are extremely fatal.

Cerebro-Spinal Meningitis.—It would appear that the condition diagnosed as cerebro-spinal meningitis in the past is the same disease as that now diagnosed as Vomiting Sickness. Duncan's District, Half Way Tree, and other places where cerebro-spinal meningitis, occurring almost exclusively amongst young children, and with a very high case mortality, are the same districts as those in which we now get the so-called Vomiting Sickness, with the same history of its preponderance amongst children, the same high case mortality, and the same rapidly fatal termination. The absence of any definite post-mortem appearances of inflammation of the meninges in any of the examinations recorded speaks against the accuracy of the diagnosis. Had these cases been cerebro-spinal meningitis some would have run a more prolonged course, sequelæ such as paralysis, blindness, and deafness would be expected, and, further, the post-mortem examinations would have shown definite inflammatory changes in the meninges.

* See also above, pp. 134 *seq.*

Ptomaine Poisoning has also been regarded by many medical men as the cause of the condition referred to as Vomiting Sickness. However, in all the cases reported to me there was no instance of a simultaneous outbreak of disease among those who partook of any particular meal. On the contrary, in the cases which occurred in groups the symptoms arose as a rule at very varying periods, and, further, in none of my cases was there any sign or symptom of intestinal inflammation such as one expects in ptomaine poisoning. There was no diarrhœa during life and no sign of inflammation to be seen after death.

Ackee Poisoning.—The ackee is very generally used as an article of food by all classes in Jamaica. It is almost invariably cooked with fish or other food. The symptoms said to follow ackee poisoning are identical with those described as Vomiting Sickness. There is no known test for ackee poisoning, and I have been unable to find any record of death from undoubted ackee poisoning. The case of David Forbes (Appendix C.), as coming under this head, is worthy of notice.

Several members of the family are said to have partaken of ackees on the 15th of March, 1907. The first is said to have been taken ill on the 15th and died on the 18th. The second to have been taken ill on the 15th and to have recovered. The third, David Forbes (the only one on whom a post-mortem appears to have been made), was taken ill on the 16th and died on the 19th. The fourth was taken ill on the 17th and recovered. The fifth, to have been taken ill on the 18th and died on the 19th. The sixth was taken ill on the 18th and died on the 20th. The seventh was taken ill on the 20th and died the same day. The eighth was taken ill on the 16th and recovered. Two others who partook of the same meal did not get ill. All the food partaken of was cooked in the same pot. It is a very remarkable thing that a poison so powerful as to kill in 24 hours (Cases 6 and 7) should have taken in one case three days, and in the other, five, before showing any effect. Again, it is remarkable that in all the descriptions of ackee poisoning previously published, no attention should have been called to the remarkable condition of the liver as found in the case of David Forbes.

Cassava Poisoning.—It has been attributed to cassava poisoning. The poison in bitter cassava is prussic acid, and if the cases in question were due to cassava poisoning the cause could hardly have been missed.

It is important to remember that the majority of cases were not seen by medical men at all, the diagnosis being made by the parents or friends, and, speaking generally, it is only in those cases where death is so sudden as to necessitate a post-mortem examination in the opinion of the legal authorities that such examination is made. Consequently, in those cases in which death takes place after the disease has lasted some days, and in which definite post-mortem appearances are to be expected, no examination is usually made. During my enquiry I had the opportunity of investigating 70 cases, the details as to symptoms and post-mortem appearances of which are given in Appendix B. From these notes it will be seen that the popular term "Vomiting Sickness" is frequently applied to a variety of diseases, *e.g.*, cases of malaria, a case of infantile paralysis, whooping cough, whooping cough complicated by broncho-pneumonia, and tubercle of the lung with death from hæmoptysis. But after eliminating these there remains a large number of other cases which cannot be attributed to such obvious causes as those given above. In a number of these the diagnosis of Vomiting Sickness was made during life by medical men who have long been familiar with the condition. The first of these cases to which I will refer is that of Rebecca Walford (Appendix B. 8). I did not see her during life, but the District Medical Officer who did was satisfied that it was a typical case. The post-mortem appearances were those which are characteristic of yellow fever; they included among other signs boxwood liver, hæmorrhages into the gastric mucosa, and icteric tinge of the tissues.

Other cases where the post-mortem appearances were similarly typical of yellow fever were those of Mrs. McClarence (35B), who died at Stewart's Town; Ethel Barnet, aged eight (47B), who died at Stewart's Town; Julia Roland (58B), who died at Brown's Mountain, and Jemima Brown (69B), aged fourteen, who died at St. Anne's Bay. This last case was seen by the District Medical Officer, who described it as one of Vomiting Sickness, a condition with which he was familiar in his present district, and which he had also seen in Chapelton.

It will be seen that in each of these cases where the post-mortem appearances characteristic of yellow fever were found, some days had elapsed between the onset

of the disease and the death of the patient. In addition to these cases in which death occurred late in the disease, and which showed the classical post-mortem signs of yellow fever, there is a group of twelve cases apparently identical in character as judged by the mode of onset, course of the disease and symptoms; and in these it will be noted from the record that the sooner death took place after the onset of symptoms, the less marked were the signs. In this group a gradual transition could be traced from those cases in which the only post-mortem appearances were an acute gastritis with hypostatic congestion of the lungs, to instances of definitely hæmorrhagic gastritis, and from simple enlargement of the liver through a stage of yellow mottling on to the complete boxwood or lemon yellow liver so characteristic of yellow fever. I am of opinion that the whole of these cases were cases of yellow fever. Appendix E. shows these cases tabulated for comparison.

I think that the reason the real character of the disease was not previously recognised is that post-mortem examinations are only done as a rule in cases where death has been too rapid to allow the characteristic changes to develop. Even in some of these cases, however, in which post-mortem examinations had been ordered on legal grounds, yellow livers, in many cases recognised as due to fatty degeneration, have been noticed, extracts from the post-mortem records of such cases are quoted in Appendix C. It may be that in these cases those making the post-mortem did not fully appreciate the significance of what they saw. In some cases the cause of death was returned as Vomiting Sickness, in others as remittent malarial fever, and in others as "vomiting," "syncope, and excessive vomiting."

This, of course, opens up the question of the endemicity of yellow fever in Jamaica. That it was formerly accepted as being endemic the following extracts from the Departmental Reports will show :—

Departmental Reports, 1881-82, page 132, Senior Medical Officer remarks on the absence of yellow fever "with the exception of a few isolated cases occasionally."

Departmental Reports, 1882-83, page 100, Senior Medical Officer comments on the absence of yellow fever for many years. Only one sporadic case occurred at Kingston. He mentions cases landed from the men-of-war and treated at Port Royal, "but I do not consider that these possessed significance."

Departmental Reports, 1885-86, page 160, "Forty-seven cases of yellow fever were recorded during the period embraced in this report. Of the total, eleven occurred at Kingston and St. Andrews, six at Sav-la-mar, in sailors arrived there in coal vessels from Barbados; the remainder originated at Port Royal amongst sailors and employees in the Dockyard and on board the guardship H.M.S. 'Urgent'; a few cases also in the garrison." "The majority of those attacked in Kingston were unacclimatised."

In the following year, 1887 and 1888, Departmental Reports, page 125, the District Medical Officer, St. Andrews, mentions malarial fevers, both intermittent and remittent; "the latter, of a very severe type, have been more prevalent this year than since 1885, and the death-rate has been proportionately high . . . and have been attended with great weakness of the heart and albuminuria; vomiting has been a troublesome symptom but has not been hæmorrhagic so far as I have seen."

Departmental Reports, 1891-92, page 4, Report 18: "A few sporadic cases of yellow fever registered in the garrison, they occurred amongst new arrivals." " . . . . There was no extension of the disease to the civil population, a proof of the purely local and sporadic nature of the affection."

Departmental Reports, 1894-95, page 193, Plantain Garden River: District Medical Officer says: "malarial fevers were prevalent; many of these in the remittent form assumed a rapidly fatal and virulent type."

With reference to the use of these words, "pernicious," "virulent," and "malignant," there can be little doubt that they have been used when yellow fever was really meant. In a joint letter signed by two District Medical Officers, dated 20th October, 1897, to the Acting Senior Medical Officer, the following sentence occurs: "I suggested that in the event of death we would hold a post-mortem examination to clear up the diagnosis. Unfortunately, the boy, Edward Alexander, died yesterday and we have held an autopsy to-day which leaves no doubt that the case was yellow fever." It is clear from this that both were satisfied that the case was one of yellow fever, yet one of these in his annual report for that year says his own district was healthy and that he had only one case of the malignant type of fever that prevailed in an adjoining district, *i.e.*, the district in which he had satisfied himself by post-mortem examination that yellow fever existed.

The letter above referred to was amongst some correspondence *re* the outbreak of yellow fever in 1897 in the Island Medical Office.

Departmental Reports, 1897-98. District Medical Officer, Half Way Tree, page 113: ". . . . There was hardly a house in my district in which fever of some sort did not occur." ". . . . While many of the cases were of an ephemeral character there were some severe ones of a pernicious type with albuminuria and hæmatemesis."

That there was a desire to suppress cases at the time the following correspondence shows:—

"(2204/97.)

"(Received October 29th, 1897.)

"Island Medical Office, Jamaica,

"COLONIAL SECRETARY, 28 October, 1897.

"YELLOW fever cases (4) reported from Christiana as recoveries and recommended by Senior Medical Officer to be not dealt with in the statistical return. Forward back return to Senior Medical Officer with Governor's minute.

"Why not? If they were cases of yellow fever they should be recorded as such.

"F. E.

"27 October."

"I quite agree. Excluding cases of recovery has the effect of making the outbreak appear of a more fatal type, and is misleading.

"H. A. B.

"28 October."

"SENIOR MEDICAL OFFICER,

"SUBMITTED.

"J. C.

"30 October, 1897."

"HONOURABLE COLONIAL SECRETARY,

"THE cases will be inserted in accordance with the Governor's instructions.

"J. C.

"30 October, 1897."

"Original to Colonial Secretary, 30 October, 1897."

Departmental Report, 1897-1898, page 109, the Senior Medical Officer remarks that the recent outbreak of yellow fever demands some notice. He writes that for the first time the disease created a restless and disturbing element unfavourable to the collection of accurate data, and that he "was surprised at the state of panic existing in Kingston and adjoining parishes."

During the previous twenty-five years he says isolated cases appeared on the island. The disease did not get a hold though there was no elaborate isolation employed, and "the public mind was not unhinged." He notes as remarkable "the comparatively large number of black and coloured people attacked." "It has been asserted that the disease was imported. I have been unable, after careful scrutiny of the facts bearing upon the assumed case, to find any ground for the assertion." Further on he states: "The disease may, and does, occur sporadically in the yellow fever zone quite irrespective of introduction from without."

Again, in Departmental Reports, 1904 and 1905, page 13, "it has been noticed from time to time, and commented on freely in the reports on outbreaks of yellow fever at Port Royal by the military and naval officers during the past thirty or more years, that disturbance of the soil, &c., was found to be contemporaneous with such epidemic or even sporadic cases of the pestilence. Personally, I am quite satisfied that sporadic cases of the fever occurred here which could only be explained on this hypothesis." The above was written by the Port Health Officer at Port Royal, and is, I think, for that reason very important evidence of the disease not having been imported. Continuing, he says: "During the last three-quarters of the nineteenth century there have been a series of epidemics of yellow fever here, varying in intensity and mortality proportional to the number of white troops and sailors stationed here."

Cases of Yellow Fever treated at Port Royal during the twenty-six years before Report (of 1904-5).

Year.	Cases.	Deaths.	If from outside Jamaica.
1878	16	11	—
1882	14	6	—
1883	4	3	H.M.S. "Mallard" from Port au Prince
1885-6	22	6	—
1890	8	1	H.M.S. "Buzzard" from Hayti.
1891	3	3	—
1897	8	6	—
1900	1	1	—
1901	1	1	—
1902	1	1	—
1903	6	1	—
1904	1	0	—

The above table is from the report on yellow fever at Port Royal, Departmental Reports, 1904 and 1905, and, I think, proves clearly that the disease was endemic there.

From the foregoing I think it is quite clear that it was by all admitted that up to the year 1904 yellow fever was looked on as endemic in Jamaica, and I think the post-mortem examinations that I have brought forward, those made not only by myself but those I have collected from amongst the reports rendered to the Attorney-General (Appendix C.) will leave no doubt that it is still endemic. I give a list of the deaths registered as due to yellow fever from 1879, when registration of deaths was first started, up to June, 1911. It must be noted, however, that registration is still very imperfect, as may be gathered from the fact that in the Registrar-General's Report for 1910 75·5 per cent. of the deaths were medically uncertified, and 2,904 deaths are shown as "fever undistinguished."

Deaths registered as due to Yellow Fever from 1897 *to June,* 1911.

Year.	Number of deaths per annum.
1879	5
1880	1
1881	5
1882	5
1883	6
1884	9
1885	28
1886	16
1887	3
1888	10
1889	8
1890	—
1891	7
1892	2
1893	—
1894	—
1895	—
1896	—
1897	76
1898	9
1899	—
1900	1
1901	5
1902	1
1903	1
1904	2

No deaths from yellow fever have been registered between the dates 1904 and July 31st, 1911.

I tried by various means to arrive at the number of cases of "Vomiting Sickness" occurring in the island. I obtained from the Registrar-General a return compiled from the registration notices of deaths which were attributed to vomiting, gastro enteritis, and inflammation of the liver. This return covers two separate periods, each of three years, namely (1) 1896, 1897, and 1898; (2) 1908, 1909, and 1910. These deaths are shown, quarter by quarter on the chart attached. There are two facts worth noting on the chart: one, the increase in deaths attributed to the above causes in the second period; the other the seasonal prevalence—the December and March quarters being the highest. With reference to the great increase in the second period, it should be stated that, amongst the cases classed as gastro enteritis, doubtless many are cases of enteric fever, and it is the general belief in Jamaica that this disease has been on the increase for some years. Another method by which I tried to arrive at some estimate of the number of cases occurring in Jamaica was by means of a return, kindly furnished by the Inspector-General of Constabulary. For some years it has been the custom in many, though not all, districts to keep a supply of medicine in police stations, to be issued free in cases of "Vomiting Sickness," and in this way a rough estimate of the cases was arrived at.

List of cases reported to the Police.

Parish.	1906–11—June 1st.	1911—January to June.
St Elizabeth	43	8
St. Thomas	10	—
St. Andrew	36	—
Portland	3	—
St. Mary	3	18
St. Ann	55	12
Trelawney	283	126*
St. James	64	—
Hanover	148	—
Westmoreland	14	—
Manchester	77	26
Clarendon	361	25
St. Catherine	50	8

* The large number of cases in this parish may be accounted for by the fact that I was working in the district at the time, and, when it became known, a large number of cases were reported as Vomiting Sickness with a view to getting treatment from me.

It is significant that one of the popular alternative names for "Vomiting Sickness" is "Black Vomit." In a circular issued by the Trelawney Board of Health the disease is referred to as "Vomiting Sickness" sometimes called "Black Vomit" or "Fits."

It is remarkable that in countries where yellow fever is admitted to be endemic, Brazil, Peru, and Mexico, there is described a disease in every way similar to the Vomiting Sickness of Jamaica. Children are mainly attacked, the onset is sudden, vomiting is a prominent sympton, the vomit is frequently hæmorrhagic, sometimes black. The case mortality is high, and in each country there exists the same desire to avoid calling the disease yellow fever.

It is also of interest to observe that of all the explanations of the cause of Vomiting Sickness, yellow fever has never been suggested, and this in spite of the fact that one of the popular terms for the disease is "Black Vomit."

In the Report of the Health of the Army for the year 1908 attention is called to a fever lasting from five to nine days.

It is said to be like influenza without any lung complications. It attacks newcomers.

The following physical signs and symptoms are given: "severe frontal headache, pains in the back of the eyes, muscular pains in the loins, and other parts of the body, vomiting, furred tongue, &c. Temperature, 103° to 105°, pulse and respiration rapid, the temperature continued high throughout; the attack ends by crisis . . . . the skin and conjunctiva not unfrequently now assume an icteric tinge with absence of bile in the stools and high-coloured urine, which occasionally also contains albumen."

The reports say that it is not Para typhoid, that malarial parasites have not been found in these cases, and that it is uninfluenced by quinine or other drugs. It has been suggested that these cases were pappatacii fever, but it is stated in the

Army Medical Report for 1910 that Phlebotomus pappatacii have never been found in the island.

A further study of these cases would be most desirable.

In conclusion, it is my opinion that there is no justification for the use of the term, Vomiting Sickness. It is not a separate clinical entity—and I am of opinion that the majority of deaths ascribed to the so-called Vomiting Sickness are due to yellow fever.

The present Senior Medical Officer appears to have been the first to point out that none of the many explanations of Vomiting Sickness was satisfactory, and that while each of the causes given might explain some of the cases, there remained a number that could not be so accounted for. He is deserving of the greatest credit for having brought forward the question of investigating Vomiting Sickness.

I beg to thank the Hon. J. E. Ker, Superintending Medical Officer, the District Medical Officers, and the private practitioners with whom I came in contact, for their kindness in affording me every facility in my work. I am much indebted to the Inspector-General Jamaica Constabulary, the District Inspectors and non-commissioned officers for the valuable assistance they afforded me, and without whose aid it would have been almost impossible to have carried on the work.

APPENDIX A to APPENDIX No. VII.

One of the first notices in the Departmental Reports 1882-3 is that of a District Medical Officer reporting cases near Duncan's, which, from the symptoms described by the friends of the deceased, he concluded was cerebro-spinal meningitis. He himself had seen no cases (Departmental Report, 1882-3, page 99.)

"An outbreak of cerebro-spinal meningitis occurred at Duncan's; the disease was most prevalent in the first quarter of the year. This disease has invariably been observed at those seasons of the year when sudden alterations between the temperature of the days and nights is most marked." (Departmental Reports, 1885-6, Senior Medical Officer, page 160.)

In 1888 and 1889 (Departmental Reports, page 125), it is stated that an epidemic closely resembling cerebro-spinal meningitis was experienced in Duncan's District, Trelawney; 191 cases, and five deaths registered as such. In 1890 and 1891 Departmental Reports, an epidemic is recorded in February and March, the chief features of which were vomiting, collapse, and (in children) convulsions. It was noted that "convulsions" when present were fatal. "The death-rate is not high." "Adults were also attacked, but very few, and no deaths occurred amongst them. It was also noted as having occurred at Half Way Tree, St. Andrew's (page 86).

In 1891 and 1892 Departmental Reports, page 6, Report XVIII., the District Medical Officer, Bull Bay: "A large number of deaths amongst children aged one to twelve. I only attended six. All symptoms were of acute spinal meningitis, five recovered and one died."

1893 and 1894 Departmental Reports, page 350, Half Way Tree: "All the cases of cerebro-spinal fever died." District Medical Officer, East St. Andrews, page 350, "in January and February a few cases of cerebro-spinal fever which proved fatal: all occurred in children under five years." District Medical Officer, Ulster Spring, page 351. "A serious epidemic of vomiting associated with a state of collapse; infants and children were the principal sufferers." Duncan's, page 352, District Medical Officer, notes "a few sporadic cases of the epidemic." 1895 and 1896. Page 186. District Medical Officer, Half Way Tree, "sixteen known cases of cerebro-spinal meningitis between the 16th January and 28th of March, all ending fatally, some dying within three or four hours." District Medical Officer, Ulster Spring, page 188, "the usual epidemic of vomiting and collapse."

Departmental Reports, 1894 and 1895, page 192, the District Medical Officer, Half Way Tree. There have been cases of cerebro-spinal fever as usual during the cool months, all fatal. The District Medical Officer, Gordontown, page 192, notes cerebro-spinal fever, "all fatal." Page 193, the District Medical Officer, Ulster Spring, notes the usual epidemic of vomiting and collapse amongst children in the lowland parts. Pages 193 and 194. The District Medical Officer, Duncan's, "the usual epidemic prevailed, characterised by vomiting and collapse."

Departmental Reports, 1896 and 1897, page 33, Senior Medical Officer in his report notes as very startling the high infantile mortality; District Medical

Officer, Half Way Tree, the usual prevalence of cerebro-spinal fever. "All the cases that came under my notice terminated fatally." District Medical Officer, Mandeville, page 42, "gastro-enteritis of very severe type in young children." Senior Medical Officer, pages 45 and 46, notes, "cerebro-spinal fever is, as a rule, confined to those districts where variations of temperature are great," and notes high mortality in young children "unless energetic measures are speedily resorted to."

Departmental Reports, 1897 and 1898. District Medical Officer, Belfield, reports number of deaths of children from two to seven, suffering from intestinal worms which were the cause of death, accompanied by convulsions.

District Medical Officer, Ulster Spring, reports the usual epidemic of vomiting and collapse amongst children, and, in a few cases, adults.

District Medical Officer, Chapelton: "During the same period an influenza epidemic was raging, January, February, March, 1898; a large number of sudden deaths among children were reported, and several deaths among adults after a short illness of fever of a day or two." The former he attributes to worms, the latter to influenza.

Senior Medical Officer's Report, 1903, notes "there were fewer case of gastro-enteritis than in the previous year; the gastro-enteritis (vomiting sickness) which proved so troublesome in past years was observed in six districts only." NOTE.—From this it will be seen by reference to the previous paragraph, that the Senior Medical Officer at this time uses gastro-enteritis as a synonym for vomiting sickness.

1902 and 1903 Senior Medical Officer's Report, "the vomiting sickness, gastro-enteritis, which proved the cause of some anxiety in previous years, is represented by only a few cases and no deaths."

1904 and 1905, the District Medical Officer, Chapelton, stated, that "the disease has been more virulent than in previous years. More adults have been attacked than in previous epidemics and the death-rate has been enormous. So rapid is the course of the disease that in many cases there has been no time to obtain assistance. Very few cases of the disease are seen, only those occurring in the neighbourhood of the village being reported, the others being only heard of after death, being reported as sudden death to the police." He goes on to say, "that the post-mortem examination of these cases reveals no naked-eye appearance of disease."

In 1906 and 1907 the Senior Medical Officer notes that Vomiting Sickness has been very much less prevalent.

In 1907 and 1908 the Senior Medical Officer notes that severe outbreaks of this disease occurred in the early part of the year in St. Andrew, Trelawney, St. James, Hanover, Westmoreland, and Clarendon. No definite cause was assigned. In Westmoreland it was believed that many of the cases were due to ackee poisoning and not to "Vomiting Sickness" so-called.

In 1908 and 1909 Senior Medical Officer's report under the heading Vomiting Sickness States: "There has been an unusual outbreak of this so-called disease during the past winter. Appended is a list kindly given me by the Registrar-General of the number of deaths which may be put down to this combination of diseases commonly called 'Vomiting Sickness.'" (Here follows a table showing the number of deaths that might have been attributed to vomiting, vomiting and fever, vomiting and convulsions.) The total for the island from December, 1908, to February, 1910, was 620.

In 1908 and 1909 District Medical Officer, St. Andrews Lr., reports an outbreak of Vomiting Sickness with 20 cases, and only one recovery.

1908 and 1909 District Medical Officer, St. Anne's Bay, notes a few cases.

1908 and 1909 District Medical Officer, Duncan's noted a few cases.

1908 and 1909 District Medical Officer, Newport. Several cases of Vomiting Sickness in low-lying districts with a high proportion of deaths.

1908 and 1909, District Medical Officer, Chapelton, records the usual epidemic of Vomiting Sickness occurring between November and March. "Treatment appears to have very slight influence in preventing high mortality."

1908 and 1909, District Medical Officer, Lioneltown, says: "Over 1,200 cases of Vomiting Sickness were reported. A large percentage of the cases treated were fever, convulsions, and worms."

In 1909 and 1910 the disease again figures in the report of the Superintending Medical Officer.

APPENDIX B to APPENDIX No. VII.

In the following cases, where reference is made to staining blood smears, the method adopted was either Leishman's or Giemsa's. Where blood culture is referred to the method adopted was to take 10 c.c.'s of blood from a vein, 5 c.c.'s were incubated ærobically and 5 c.c.'s anærobically in 250 c.c. of broth + 10 Eyre's scale. Blood counts of the cases in which it was found possible to make them will be found in Table F. A culture was concluded to be sterile if there was no growth after incubation for five days at 37° C. In cases where [there is] no mention of the administration of quinine, none was given, and only where quinine was said to have been take is the fact mentioned.

The notes on many of the following cases may appear short and imperfect. It is to be remembered that these cases occurred over a wide area, and consequently much time was taken up in travelling. The absence of a laboratory attendant limited the amount of work that could be done in the improvised laboratory at the Police Station in Duncan's. The only animals available for inoculation experiments were rabbits and guinea pigs, as the employment of apes for this purpose was not sanctioned by the Government of Jamaica.

List of Cases seen and Post-Mortems made by me.

1. 30th December, 1910.—Child, Robins, female, black, aged five, Siloah, Balaclava. Child was reported sick, vomiting and fever on 28th of December, 1910. Seen by Dr. Strudwick on 29th December, 1910. Case seen by me on the 30th. Well-nourished child, had vomited three or four times. Blood smears showed the case to be one of benign tertian malaria.

2. 14th January, 1911.—Gopal, coolie, several years resident in Jamaica, aged fifty, residing at Bounty Hall, Falmouth District. Was reported as a case of Vomiting Sickness. He was removed to the hospital in Falmouth, where he was seen by Dr. Myers, Dr. Purchas, and myself in consultation. Dr. Purchas decided that it was not a case of Vomiting Sickness. He had vomited bilious matter three or four times. Blood smears showed quartam parasites. He recovered.

3. 15th January, 1911.—Naomi Stewart, aged four, black, a well-nourished child, was taken ill on the morning of the 15th, seen by me at 10 a.m. She was completely paralysed in the left arm and leg. She died the same evening at seven. Post-mortem examination at 7.30 on the morning of the 16th. Brain and cord normal. Lungs slightly congested. Heart normal. Three round worms in small intestine. All the other viscera normal. Cause of death, infantile paralysis.

4. 15th January, 1911.—Leonora Peirce, at Bounty Hall, aged thirteen, black, a well-developed girl, was stated to have been ill for about 10 days; she had vomited once or twice; vomited matter was said to be only the food she had taken. Blood smears showed the case to be one of benign tertian malaria, and she quickly recovered under quinine.

5. 16th January, 1911.—L. E. Reid, male, black, aged 3 years and 6 months, Fray-Town, Falmouth District, was reported as a case of Vomiting Sickness. The case proved to be one of malaria, benign tertian parasites being found in the blood. He quickly recovered under quinine.

6. 16th January, 1911.—Robert Kerr, black, aged 6, Daniel Town, Falmouth District, was reported as a case of Vomiting Sickness. On enquiry the grandmother stated that he had vomited two or three times in the previous week. The boy was quite well at the time of my visit.

7. 16th January, 1911.—Edmunda Moss, half-sister of the boy Kerr, aged 3 years and 7 months, was also reported as a case of Vomiting Sickness. She was said to have vomited two or three times during the previous week. She was quite well when seen by me, and blood smears showed no malarial parasites.

8. 18th January, 1911.—Rebecca Walford, aged 19 years, a coloured girl, well-developed, became ill on 14th January, 1911. She was said to have suffered from fever, severe pain in the back and epigastrium; she was rather better the next day, but on the night of the 15th became very ill. She vomited two or three times that night. The vomited matter was described as yellow at first and then dark. The patient was seen by Dr. Purchas on 17th January, 1911. She was then almost comatose, and died about midnight. Dr. Purchas described this case to be as a

typical case of Vomiting Sickness. I did not see the patient during life, but made a post-mortem examination at 9.30 a.m. the following morning. Rigor mortis was well-established. The sclera were yellow, and on cutting into the tissues they were of a deep yellow colour.

Thorax.—There were numerous sub-pleural hæmorrhages, and both lungs were in a state of hypostatic congestion. The trachea and bronchi were full of blood-stained mucus. There were several sub-pericardial hæmorrhages. There was a large ante-mortem clot in the right ventricle extending up into the pulmonary artery.

Abdomen.—The peritoneum contained some yellowish fluid. The liver was enlarged, extending some three inches below the costal margin. It was of a lemon colour, and portions floated when put in water.

The stomach.—*Contents:* Consisted of some four ounces of clear fluid with some small black specks throughout. The mucous membrane was deeply congested, more so at the pyloric end and along the lesser curvature, and there were some small hæmorrhages.

The duodenum.—For about half its length was deeply congested, and there were some small hæmorrhagic patches. Small intestine, cæcum, and colon were normal. Twelve round worms were found in the small intestine.

The pancreas was enlarged and congested.

The spleen normal.

The kidneys were congested and the supra-renals enlarged. The mesenteric glands were enlarged.

The bladder was empty.

The uterus was normal (no hæmorrhages).

The brain and cord were normal, but there was some congestion of the meninges.

Smears and sections of all organs stained by Leishman's and Giemsa's methods showed no malarial parasites.

Microscopically the liver was in a state of fatty degeneration. The kidneys showed acute tubular nephritis.

9. 18th January, 1911.—Sarah Clarke, aged 18, a well-developed black girl, at Ginger Hall, Rio Bueno, was reported as a case of Vomiting Sickness. I saw her about 11 a.m. She was stated to have been quite well until the 16th, when she suffered from fever, pains in the back, and headache. She vomited about 10 p.m.; vomited matter was said to have been the food she had taken. Next morning the vomiting continued, and was said to have been clear, yellow mucus. When seen by me temperature 104°, pulse 90, respirations 18. She complained of severe epigastric pain; there was tenderness on pressure over the epigastrium, and whilst I was present she vomited twice. There was no definite enlargement of the liver. The vomited matter was bile-stained. There was no blood and the vomiting was without apparent effort. Blood culture was made, and both ærobic and anærobic cultures proved sterile. Blood smears showed no malarial parasites. She recovered.

10. 18th January, 1911.—Ellen Clarke, sister of Sarah Clarke, aged 16, a well-nourished black girl, was taken ill on the 17th. She complained of fever, headache, pains in the back and a desire to vomit. There was marked tenderness over the liver, which was enlarged to about two fingers' breadth below the costal margin. There was epigastric pain and tenderness. She had vomited three or four times, the vomit at first consisting of the food she had taken, after that of clear mucus. Temperature 100, pulse 84, respirations 18. Blood culture was made, cultivated ærobically and anærobically; both were sterile, no malarial parasites were found in the blood. She recovered.

Both these cases were seen in consultation with Dr. Purchas, who described them as typical cases of vomiting sickness.

11. 18th January, 1911.—Margaret Reid, a black child aged five, at Sawyers, was reported as having died of Vomiting Sickness. No post-mortem was made, as I was unable to go to the case owing to pressure of work in other directions.

12. 20th January, 1911.—Sarah Case, aged 29, a well-nourished black woman. This woman was stated to have been working in the cane-fields at Long Pond until three o'clock on the afternoon of the 18th, when she complained of feeling ill and

went to her home at Monteith. She is stated to have suffered from fever for a few days before the 18th, but that it did not interfere with her work. On her way home she vomited several times, and died about 7 p.m. on the night of the 19th. Post-mortem made at 10 a.m. on the morning of the 20th. Rigor mortis had passed off. The sclerotics were yellow. There was much post-mortem lividity. On cutting into the tissues they were yellow.

Thorax.—Pericardium normal, heart normal, pleuræ normal, both lungs in a state of hypostatic congestion, trachea and bronchi contained blood-stained mucus.

Abdomen.—Peritoneum normal, stomach contained about 8 ounces of fluid, clear, with some specks of blood. The pyloric end was deeply congested. There were some small hæmorrhages into the wall; the lesser curvature was also congested.

The liver.—The liver was enlarged to about two inches below the costal margin. It was of a purple colour with numerous areas of a light yellow, and this was more marked on section.

The kidneys were congested.

The supra-renals were enlarged and congested.

The bladder was empty.

All the other organs were normal and there were no intestinal parasites. Smears and sections from the organs showed no protozoa; sections of the liver showed the cells in a state of cloudy swelling; there was no fatty degeneration. The mother and son of this woman were both in good health at the time I made the post-mortem examination. Both died from "Vomiting Sickness" within three days of her. I was at Montego Bay at the time, so did not see them. No post-mortem examination was made.

13. 20th January, 1911.—Child, Brown, $6\frac{1}{2}$, a well-nourished black boy, living at Haddington, was reported as a case of Vomiting Sickness to Dr. Purchas. On arrival we found the boy dead. He was stated to have been quite well until the evening of the 18th. He complained of slight fever and "bad feelings in the belly." He however took his food on the 19th. On the morning of the 20th, about five o'clock, his parents heard him vomiting. He vomited several times, the vomited matter being described as yellow. He became unconscious about 7 a.m.; he had "fits" two or three times and died about 8 o'clock. I made a post-mortem examination, at which Dr. Purchas was present, at 12 noon.

Thorax.—Pericardium and heart normal, lungs in a state of hypostatic congestion, trachea and bronchi contained blood-stained mucus.

Abdomen.—The stomach was deeply congested throughout. There were several small hæmorrhagic patches; the contents consisted of about eight ounces of clear mucus.

The liver was enlarged with several pale areas; on section this was more apparent.

The other organs were all normal. Smears from the different organs and sections stained by Leishman and Giemsa showed no malarial parasites.

14. 21st January, 1911.—Infant, one year and six months, a black child. This case was reported as a death from Vomiting Sickness through the police. On arrival at Refuge I found an ill-nourished child which had been dead for some hours. The mother had deserted it. There was no history to be obtained and the post-mortem revealed no obvious cause of death.

15. 21st January, 1911.—Thomas Barnett, aged seven years, black. This was reported as a death from Vomiting Sickness—the history given by the parents being that the child was quite well until the previous evening, when he vomited some blood. He died about 4 o'clock a.m. Post-mortem examination at 7.30 a.m. The body was that of an ill-nourished boy.

Both lungs showed advanced tubercular disease and at the apex of the left lower lobe there was a cavity; into this a vessel had ruptured; the lungs contained much blood, and the stomach contained a small quantity of blood and mucus which doubtless had been swallowed.

Cause of death.—Tubercle of lungs.

16. 21st January, 1911.—Iris Kerr, aged fourteen, a well-nourished black girl, Daniel Town, Falmouth. The case was reported as one of Vomiting Sickness.

On arrival I found her quite unconscious. Temperature 102°, pulse 94, respirations 22. She was stated to have been quite well up to the evening of the 19th, when she refused her food, complained of headache, pains in the back and legs. The following day she was worse and vomited two or three times. The vomited matter was bile-stained. The scleræ were yellow, she was quite unconscious and had passed no urine on the previous day. The liver was enlarged to about two inches below the costal margin. She died the same night. No post-mortem was obtained. Blood smears showed no malarial parasites and blood cultures proved sterile.

17. 23rd January, 1911.—Fabian Hendrick, Carey Park, aged 37, black. Reported as a case of Vomiting Sickness. Blood smears showed the case to be one of malignant tertian malaria. Case cleared up under quinine.

18. 23rd January, 1911.—Susan Mackey, Carey Park, aged 27, black. Reported as a case of Vomiting Sickness. Blood smears showed the case to be one of malaria and she recovered under quinine.

19. 23rd January, 1911.—Theophilus Gordon, aged 40, Carey Park, black. Reported as a case of Vomiting Sickness. Stated to have vomited two or three times. Blood smears showed the case to be one of malaria, and he recovered under quinine.

20. 23rd January, 1911.—Eliza Powell, aged 50, black, Carey Park. Reported as a case of Vomiting Sickness. Blood smears showed the case to be one of malaria and she recovered under quinine.

21. 24th January, 1911.—Boy, Walford, aged 14, Bethel Town (a brother of Rebecca Walford, case 8), black, was reported as a case of Vomiting Sickness. The history given was that the boy became ill on Saturday the 22nd. He was said to have vomited three or four times and was seen by Dr. Purchas on the 23rd.

I saw him on the 24th. Temperature normal, pulse 96. There was no enlargement of the liver. Spleen not palpable. Urine contained no albumen. Blood smears showed no malarial parasites. He recovered.

22. 24th January, 1911. Eliza Hynes, aged 60, black, living at Calabar. The case reported as one of Vomiting Sickness. History was that she was quite well until Saturday the 21st when she suffered from fever, headache, pains in the back. On Monday she felt better, but on Tuesday morning she awoke suffering from severe epigastric pain and vomited three or four times. Temperature 104°, pulse 90, respirations 22. There was severe epigastric pain and tenderness. The liver was enlarged to about 1 inch below the costal margin. None of the vomited matter was obtained, but it was said to have been clear mucus. Blood cultures and smears were made. No malarial parasites were found and cultures proved sterile. The case was seen in consultation with Dr. Purchas, who decided that it was a case of Vomiting Sickness. She recovered.

23. 24th January, 1911. Elsada Sutherland, aged 22, a well-nourished girl, black, Dry Hill. Reported as a case of Vomiting Sickness. She was stated to have been quite well until the evening of the 21st when she complained of headache and fever. On the 22nd she was still feeling ill but she was able to go about her work. That evening she felt much worse and vomited three or four times. The vomiting had continued up to the time I saw her. The vomited matter consisted of bile-stained mucus. There was some epigastric tenderness. The liver was enlarged and very tender. Temperature 102°, pulse 100, and respirations 20. Urine contained bile and a small amount of albumen.

25th January, 1911.—Condition much the same. Pulse 90, temperature 96°. There had been no more vomiting. Urine, trace of albumen.

27th January, 1911.—Temperature normal. Pulse 80. Urine, no albumen. She recovered.

Note.—House separated from that of A. L. Edwards, case 65, by only a narrow roadway.

24. 24th January, 1911.—E. Lang, aged 9, a black girl, well-developed child, Carey Park. Was reported as a case of Vomiting Sickness. Examination of the blood showed the case to be one of benign tertian malaria, and she recovered under quinine.

25. 25th January, 1911.—Edith Harrison, black girl, aged 13, New Cargeen. Was reported as a case of Vomiting Sickness. She became ill on the 20th of January, 1911. Headache, fever, and pain in her back. She vomited three or four times on the 24th, vomited matter being bile-stained. On the morning of the 25th I saw her about eleven o'clock. She had vomited about ten minutes previously, the vomit being "coffee-ground" matter. Temperature 104°, pulse 96, respirations 20. There was a good deal of epigastric tenderness. The liver was enlarged for about 2½ inches below the costal margin and there was much tenderness over the hepatic area. The urine contained bile and a small amount of albumen. She recovered.

27th January, 1911. General condition the same, but she had not vomited since the night of the 25th. Liver still enlarged. Temperature 100°, pulse 90. No jaundice. Urine, small amount of albumen.

26. 26th January, 1911. Thomasina Thompson, aged nine, black, Crawle. Reported as a case of Vomiting Sickness. She was said to have vomited three or four times; the vomited matter consisting at first of foodstuff and later of clear mucus. Examination of the blood showed the case to be one of malaria, benign tertian. She recovered.

27. 26th January, 1911. Ivan Dixon, half-brother to Thomasina Thompson, aged seven, black, Crawle, was said to have been ill for some days with fever. Examination of the blood showed the case to be one of malaria, benign tertian. He recovered.

28. 26th January, 1911.—Joseph Grey, aged nine, coloured boy, Duncan's, reported as a case of Vomiting Sickness; the boy was suffering from whooping cough.

29. 26th January, 1911.—Lela Curton, aged three, black, Carey Park, reported as a death from Vomiting Sickness. The history of the case was that the child had been suffering from whooping cough, and post-mortem examination showed the cause of death to be broncho-pneumonia.

30. 26th January, 1911.—Henry Thomas, aged 3½, black, Dry Hill; the case was reported as one of Vomiting Sickness. The child was said to have vomited twice during the previous night, to have been better during the day time, and to have been attacked with vomiting and diarrhœa about six o'clock in the evening. Temperature 104°, pulse 92, respirations 23. The case turned out to be one of infantile diarrhœa. Blood smears and blood cultures proved negative. He recovered.

31. 27th January, 1911.—Ada Kerr, aged seven, black, Duncan's. History: the child was said to have been quite well up to the previous afternoon when her school mistress noticed that she was making attempts to vomit; she sent her home, and the child appeared to get better; she was able to eat her supper and was put to bed, apparently well; about 4.30 a.m. her step-mother heard her vomiting; she died almost immediately, and some vomited matter was found in the bed alongside her. Post-mortem examination made at 7 a.m.

Thorax.—Lungs deeply congested. Trachea and bronchi contained blood-stained mucus, pericardium and heart normal.

Abdomen.—Peritoneum normal, stomach deeply congested, particularly lesser curvature and at pyloric end. No hæmorrhages; liver enlarged, purple, showing lighter areas, some very light in colour.

Kidneys.—Congested.

All the other organs normal. The small intestine contained 110 round worms, these were knotted into masses which distended the gut in places to the size of a man's fist. Smears of the organs and sections showed no malarial parasites. Microscopic examination showed cloudy swelling of the liver cells.

32. 27th January, 1911.—Martin Kerr, aged 6, brother to Ada Kerr (case 31), was quite well at the time when he was put to bed with his sister. Whilst the step-mother was attending to Ada Kerr the brother was noticed to be vomiting. I saw him at 5 a.m., he was then comatose; the conjunctival reflex was absent. He had occasional attacks of convulsions. He was almost pulseless, and the temperature was subnormal.

Both children had partaken of supper with five other members of the family, all adults, none of whom suffered in any way. There were attempts at vomiting.

He never recovered consciousness, and died at 2 p.m. Post-mortem examination made at once.

Thorax.—The lungs were slightly congested, heart and pericardium normal, brain and cord normal, meninges slightly congested.

Abdomen.—Stomach empty, mucous membrane congested along lesser curvature, and hæmorrhages at pyloric end. Liver enlarged, small intestines contained 150 round worms.

Kidneys.—Congested.

Bladder.—Empty.

Other organs normal. Smears and sections of the organs showed no malarial parasites, and blood smears taken during life were also negative.

33. 30th January, 1911. Ethel Spence, aged 7, black, Duncan's, reported as a case of Vomiting Sickness. She was said to have vomited two days previously, but when I saw her was quite well, and on examination of the blood, both smears and culture were negative. She recovered.

34. 30th January, 1911.—Charles Henry Thorp, aged 9, black, Schwartschmid, Duncan's, reported as a case of Vomiting Sickness. History : Had been quite well until he got an attack of " fever " on the evening of the 27th. He was better the next day, and had another attack of " fever " on the 29th. Blood smears showed the case to be one of benign tertian malaria, and he recovered under quinine.

35. 30th January, 1911.—Mrs. McClarence, aged 22, coloured, Wilson Vale, Stewart's Town. History : Patient was said to have been quite well on the morning of the 28th. She went to Brown's Town market, and on the way back felt sick, complaining to some of her companions of " a bad feeling in the belly." When she arrived home she lay down, and soon after vomited. She vomited two or three times during the night. On Sunday she was ill all day; towards evening she vomited a couple of times, and then became semi-unconscious. When I saw her on Monday morning she was quite unconscious, almost pulseless, temperature sub-normal; had passed neither urine nor fæces during the previous 24 hours. The liver was enlarged to about two inches below the costal margin. The urine was almost solid with albumen. I saw none of the vomited matter, but the relatives described it as " very dark." She died the same night about 10 p.m. I made a post-mortem examination next morning about 8 a.m. The scleræ were yellow, and there was much post-mortem staining.

Thorax.—Tissues yellow on section. Pericardium : there were several sub-pericardial hæmorrhages. The heart was normal, but contained an organised clot extending up through the pulmonary artery. Lungs were deeply congested, and there were several sub-pleural hæmorrhages.

Abdomen.—The liver was much enlarged, and light yellow in colour. Pancreas was enlarged.

Kidneys.—Were congested, and there was an old pyelitis on the left side; the supra-renals enlarged.

Stomach.—Contained a few ounces of clear fluid in which were several black specks. The stomach was deeply congested with hæmorrhagic patches along the lesser curvature and at the pyloric end. The duodenum for about half its length from the pylorus was also congested.

The other organs were normal, and there were no intestinal parasites. The brain cord and meninges were normal.

36. 30th January, 1911.—Child Cooper, aged 4, female, black, Carey Park, reported as a case of Vomiting Sickness. The child was said to have been for three days suffering from fever and abdominal pain. Blood examination showed the case to be one of benign tertian malaria, and she recovered on the administration of quinine.

37. 30th January, 1911. Cooper, male child, aged 3, black, Carey Park, brother to the previous case, also reported as a case of Vomiting Sickness. The mother said the child had been suffering from " fever " for a week, and had vomited whenever it was given food. Examination of the blood showed the case to be one of malaria, and he recovered on the administration of quinine.

38. 30th January, 1911.—Child Higgins, aged 2½, black, Duncan's. This

case was reported as one of Vomiting Sickness, but proved to be a case of whooping-cough.

39. 31st January, 1911.—Christina Thompson, aged 8, black, reported as a case of Vomiting Sickness. The girl, a well-nourished child, was stated by the mother to have suffered from fever on the 27th. Seen at 11 a.m. on the 31st. Temperature 102°, pulse 100, respirations 20. Complained of headache, pains in the back, and a desire to vomit. She had vomited twice that morning, the first time during her illness. The vomited matter was bile-stained, but contained no blood. The liver was enlarged. There was epigastric tenderness and pain. The spleen was not palpable. The bowels were confined. The urine contained bile, but no albumen. She recovered.

40. 1st February, 1911.—Judith Grant, aged 45, black, a well-nourished woman, was said to have been taken suddenly ill about midnight on the night of the 31st. She complained then of headache, pains in the back, and fever. About 5 a.m. she vomited. I saw her first at 7 a.m. She was then unconscious. No conjunctival reflex, pupils dilated and fixed, temperature sub-normal. Some frothy blood-stained mucus about the mouth. The bladder was empty. She continued in a state of coma, and died about 1 o'clock. Post-mortem examination made at once.

Thorax.—Base of both lungs in a state of hypostatic congestion, pleuræ normal, pericardium and heart normal.

Abdomen.—The liver was enlarged, congested, and bled freely on section. Gall bladder was distended with bile. Pancreas enlarged, spleen normal. The stomach was congested throughout. There were some petechial hæmorrhages. It contained about 6 ounces of coffee-ground matter.

Blood smears taken during life showed no malarial parasites, and blood cultures were sterile. Smears and sections of the organs showed no protozoa.

41. 1st February, 1911.—Ivan Shirley, aged 9, black, son of Judith Grant, was said to have been taken ill about the same time as his mother. When I saw him he was unconscious. Temperature subnormal, pulse imperceptible, respirations shallow and rapid. He never recovered consciousness, and died about 11.30 a.m. Brain and cord normal; meninges ditto.

Thorax.—Pleuræ normal, both lungs in a state of hypostatic congestion, trachea and bronchi contained blood-stained mucus, heart and pericardium normal.

Abdomen.—Liver was enlarged and purple in colour, gall bladder slightly distended, spleen normal, pancreas normal, kidneys congested, stomach deeply congested throughout, particularly along the lesser curvature and at the pyloric end. There was no actual hæmorrhages into the wall. Contents, about four ounces of mucus, containing coffee-ground matter. The bladder contained four ounces of urine, which was free from albumen. Mesenteric glands were enlarged. Six round worms were found in the small intestine.

Blood smears taken during life contained no malarial parasites and blood cultures were sterile.

42. 1st February, 1911.—John Holland, aged 6, black, Carey Park, was reported as a case of Vomiting Sickness. I saw him about 3 p.m. His father stated that he had been quite well the previous evening. He complained of head-ache in the morning, and his father said he had fever. He refused his breakfast but drank a little condensed milk, which was retained only a short time. He had vomited about four times between daybreak and the time I saw him. Temperature 104°, pulse 120, respirations 30. There was some epigastric tenderness, the spleen was not enlarged but the liver was slightly enlarged and tender. I did not see any of the vomited matter myself. Blood smears showed no protozoal organisms. Condition at 9 p.m.: He had vomited once or twice in the interval. Temperature 104°, pulse 110, respirations 30. The bowels had not been opened. He had passed water, which was clear and contained no albumen. He died on the 2nd at 1 p.m. He was said to have been unconscious from daybreak, about 5 a.m., and to have suffered from "fits."

Post-mortem examination made at 5 p.m. Rigor mortis was well established. There was some post-mortem staining. Brain and cord normal.

Thorax.—Base of both lungs in a state of hypostatic congestion. Lungs and trachea contained frothy, blood-stained mucus, pleuræ were normal, heart and pericardium normal.

Abdomen.—The liver was enlarged, of a purple colour with yellow mottling. Gall bladder contained a small quantity of bile. Spleen normal. Pancreas normal.

Stomach, deeply congested, contained some blood-stained mucus, and there were a few petechial hæmorrhages near the pyloric end. The duodenum was congested, the remainder of the bowel normal, contained ten round worms. The bladder contained three ounces of urine, which was free from albumen. Kidneys congested Supra-renals ditto. Mesenteric glands were enlarged. Sections of the organs showed malarial parasites, but the liver cells were in a state of cloudy swelling.

43. 1st February, 1911.—Holland, female, black, aged four, Carey Park, sister to the previous case. Was said to have been quite well until the morning of the 30th, when she was found to be suffering from fever. Complained of headache, but as she could take her food the parents did not think it serious. On the 31st she still had "fever." She did not vomit. Seen at the same time as her brother. She had a temperature of 103°, pulse 100, respirations 25. There was slight epigastric tenderness, no enlargement of liver or spleen. Blood smears showed no malarial parasites. Seen next day, her temperature was normal, and she recovered, though convalescence was prolonged. No albumen found at any time in the urine. She recovered.

43. 1st February, 1911.—Holland, Mrs., aged 36, black, stated that she had suffered from fever about ten days previously. She was ill for four days. She never actually vomited but felt inclined to; she was able to do her work. She had no rigor. When seen by me on the 1st of February her temperature was normal, pulse 80, the urine was free from albumen. Blood smears showed no malarial parasites. She recovered.

44. 1st February, 1911.—A black woman, said to be 106 years of age, grandmother of the Holland children, living in the same house. Was said to have suffered from fever at the same time as Mrs. Holland. She complained of "bad feeling in the belly." She had felt an inclination to vomit but had not actually done so. When seen by me her temperature was normal, pulse 80, there was no enlargement of the liver or spleen. Blood smears showed no malarial parasites. I was unable to obtain a specimen of urine. She recovered.

45. 1st February, 1911.—Lindsay, J., male, black, aged 60, residing at Spring, in Duncan's District. Was reported as a case of Vomiting Sickness. History: He had been ill for three days, suffering from fever. He complained of headache, pains in the back, and said he had vomited three times between daybreak and 4 p.m. The vomited matter he described as "food and yellow stuff." Temperature 102°, pulse 96, respirations 20. He had had no rigor, the bowels were confined, the urine free from albumen. Seen again upon the 2nd. His condition was much the same, temperature 102°, pulse 100, respirations 20. The bowels had been opened by calomel, there was some tenderness over the liver, but no enlargement. Blood smears taken on both days showed no malarial parasites, and blood cultures were sterile. He recovered, and specimens of urine taken at intervals during the following week showed no albumen, and the pulse rate never fell below 80.

46. 1st February, 1911.—Queen Wylie, aged 40, Duncan's. Reported as a case of Vomiting Sickness. When seen she stated that she had been ill with fever and vomiting for two days. Pulse almost imperceptible and uncountable. She had vomited "many times" during the night. The vomit she described as being food she had taken and after that clear mucus. There was no blood, no coffee-ground matter. Temperature sub-normal; there was much epigastric tenderness and pain. The liver was enlarged and tender.

Blood smears showed no malarial parasites and blood cultures were sterile.

On the 2nd.—Temperature 100°, pulse 120, vomiting had almost ceased. The epigastric tenderness and pain were still present. There was no jaundice. She recovered after a week. The pulse at no time fell below 80. I was only able to get two specimens of urine, one on the 1st and the other on the 5th. In neither case was there albumen. She recovered.

47. 2nd February, 1911.—Ethel Barnett, aged 8, black girl, Stewart's Town. Reported as a death from Vomiting Sickness. History: She was said to have been quite well until the morning of the 28th, when she complained of fever and headache. There was no history of rigor. She suffered from "fever" on the 29th, 30th, 31st, and 1st. She died after midnight of the 1st. Post-mortem made at 9 a.m. on the

2nd. A well-nourished child, much post-mortem stain, slight yellow tinge in scleræ. Rigor mortis was passing off. The mouth contained some bloody mucus and coffee-ground matter. Brain and cord normal, meninges ditto.

Thorax.—Heart and pericardium: the pericardium contained about four drachms of straw-coloured fluid. There were a few sub-pericardial hæmorrhages. There was a large ante-mortem clot in the right side of the heart. Pleuræ: Sub-pleural hæmorrhages, most marked on the right side. Lungs deeply congested throughout contained bloody mucus.

Abdomen.—The stomach was deeply congested, particularly along the lesser curvature, where there were some hæmorrhagic spots. Contents, about four ounces of coffee-ground matter with some small specks of blood. Duodenum deeply congested throughout its length. Small intestine contained four round worms. The liver enlarged, a pale yellow colour. The gall bladder contained a little bile. The spleen was normal, the kidneys congested, and the bladder contained about three ounces of urine. This urine contained a small quantity of albumen. Uterus normal, the mesenteric glands were enlarged, the other viscera normal. Smears and sections of the organs showed no malarial parasites, the liver was in a state of fatty degeneration and the kidneys in a state of cloudy swelling.

48. 2nd February, 1911.—Rebecca Evans, aged 2, black, daughter of Judith Grant, case 40. The child was reported as a death from Vomiting Sickness. She had been with the mother on the night of her illness. She was taken away by the neighbours, and was said to have been quite well up till midnight on the 1st. About daybreak the friends who were looking after her heard her "choking." They took her out of bed and she vomited once or twice. She appeared to get better, but was again attacked with vomiting about 10 o'clock. She became unconscious, suffered from "fits," and died before noon. Post-mortem examination at 5.30 p.m. A well-nourished infant. Brain, cord, and meninges normal. The lungs in a state of hypostatic congestion, filled with frothy mucus which was blood stained. Heart and pericardium normal.

Abdomen.—The stomach was deeply congested, as also the duodenum. The liver was enlarged, purple in colour, the kidneys were congested, the other organs normal, the bladder was empty, and three round worms were found in the small intestine. Smears and sections from the various organs contained no malarial parasites.

49. 2nd February, 1911.—Princess Burke, 45, black, Carey Park. Reported as a case of Vomiting Sickness. Stated she had been vomiting at intervals for the past two days. She had not had fever, but had "bad feeling in the head and belly." The vomited matter was at first food-stuff and later clear mucus. There was slight tenderness but no enlargement of the liver. The spleen was not palpable, there was some epigastric pain and tenderness. The bowels were confined. Blood smears showed no malarial parasites and cultures were sterile. Temperature and pulse were normal. After a dose of calomel the bowels were freely moved the next day, and she had no return of the symptoms.

50. 2nd February, 1911.—Annie Brown, aged 17, Carey Park, reported as a case of Vomiting Sickness. She lived in the same house as Princess Burke. History: She had suffered from fever and cold shiverings. Examination of the blood showed numerous malarial parasites, benign tertian, and she recovered on the administration of quinine.

51. 3rd February, 1911.—May Innis, aged 9, black, Pimento Walk, reported as a case of Vomiting Sickness. The case proved to be one of whooping-cough.

52. 3rd February, 1911.—Margaret Innis, aged 6, black, also reported as a case of Vomiting Sickness, proved to be whooping-cough.

53. 3rd February, 1911.—Emmeline Steele, aged 2, black, reported as a case of Vomiting Sickness. On arrival I found the child dead. The mother stated she was quite well the previous day. During the night she heard her vomit, got up and attended to her; about daybreak she vomited three or four times, then became unconscious, passed into a state of coma, and died about 9 a.m. Post-mortem at 10. A fairly [well] nourished child. Rigor mortis was well established. Brain and cord normal.

Thorax.—Lungs in a state of hypostatic congestion at the base. The trachea, bronchi, and mouth were full of frothy blood-stained mucus. Heart and pericardium normal.

Abdomen.—The stomach was congested and contained a little cornmeal pap. The other organs were normal, bladder contained a small quantity of urine, which was free from albumen. There were four large collections of round worms in the small intestine, matted together, each mass the size of a small orange. The worms numbered over a hundred. Smears and sections of the various organs showed no malarial parasites.

54. 3rd February, 1911.—Alexander Steele, aged 6, black, brother of Emmeline Steele, was reported as a case of Vomiting Sickness. The mother stated that he had complained of "bad feelings in the belly" for three or four days. He had not vomited, but felt as "if the food would come up." He had not suffered from fever. Examination of the blood smears showed no malarial parasites. There was a history of his having passed round worms. He was given some santonin, next day passed several round worms and became quite well.

55. 6th March, 1911.—Ellen Rose, aged 32, black, Clark's Town. The case, which was under the care of Dr. Purchas, was seen in consultation with him. History: The patient appears to have been quite well up to the 4th. She was then taken ill with vomiting, "once or twice." She was seen by Dr. Purchas, who found her in a state of collapse. Pulse small and thready. She complained of headache, pains in the back, and general malaise. I saw her on the morning of the 6th, with Dr. Purchas. The vomiting had ceased, her temperature was normal, pulse 74, the tongue was dry and coated with a brown fur. She was very weak. There was epigastric tenderness, slight enlargement of the liver, spleen was not palpable, the urine was free from albumen. There was a slight icteric tinge in the scleræ. I did not see her next day, but saw her on the 8th. Her temperature was still normal, pulse 76, icteric tinge was more pronounced in the scleræ, and she remarked that the neighbours "noticed the yellow jaundice in her eyes." The urine was free from albumen. She ultimately recovered. Pulse never got slower, the jaundice cleared up and she never had albumen in the urine.

56. 8th March, 1911.—R. Hamilton, 15 months, a black male child, Duncan's. The mother stated that the child had been apparently quite well up to the previous evening. About 4 a.m. she heard him "smothering." She found his mouth covered with bloody mucus. He vomited two or three times and then became comatose. He died without recovering consciousness about 7 a.m. Post-mortem examination at 9. A well-developed child. Brain and cord normal.

Thorax.—Pericardium and heart normal, both lungs in a state of hypostatic congestion containing frothy blood-stained mucus.

Abdomen.—The liver was enlarged, of a purple colour showing a lighter mottling, in places almost yellow. The gall bladder was distended with bile. The spleen was normal, the stomach was deeply congested, and contained some coffee-ground matter. The duodenum was congested, remainder of the bowel normal. The bladder contained about an ounce of urine, which was free from albumen. Smears and sections of the organs showed no malarial parasites. This child died in the same yard, but in a separate house, from that in which cases 40, 41, and 49 resided.

57. 3rd March, 1911.—E. Mitchell, aged 45 (?), black woman, residing at Calabar, reported as a case of Vomiting Sickness. She stated that she had suffered from fever for the previous two days. On the morning of the 8th she vomited. The vomited matter was "yellow." When I saw her she was very collapsed, complaining of severe epigastric pain. The liver was enlarged and tender, the spleen was not palpable, temperature 96°, pulse 80. The urine contained no albumen. Blood smears showed no malarial parasites and blood cultures were sterile. Seen again on the 10th her temperature was normal, pulse 80. She had vomited four times on the 9th, the vomit being described as "yellow." The urine was free from albumen. She made a good recovery. The pulse never fell below 76, and the urine never contained albumen. She recovered.

58. 9th March, 1911.—Julia Roland, aged 44, black, Brown's Mountain, reported as a death from Vomiting Sickness. The patient had died the previous evening. History: She had been attending her niece Sheba, who was suffering from fever attended by vomiting. The niece had been taken ill on Saturday; lived in the same house as the aunt, but on her return from Falmouth where she was taken ill, she had been taken to her mother's house a couple of hundred yards away. The aunt accompanied her. On Monday afternoon she, Julia Roland, suffered from

" fever," there was no rigor, she suffered from intense headache, pains in the back; she still continued to nurse her niece. On Tuesday her condition was much about the same. On Tuesday evening she got rapidly worse, complaining of severe epigastric pain, she started vomiting and continued to vomit all night. The vomit at first was yellow, then it is said to have contained a little blood, and to have been " dark " on Wednesday morning. She passed into a state of coma on Wednesday morning, and died about noon on the 8th, Wednesday. Post-mortem examination at 8 o'clock on Thursday, the 9th, in the morning. The body was that of a well-nourished woman. There was a distinct icteric tinge in the scleræ. The tissues were a deep yellow; the mouth contained some dark fluid. The brain and cord were normal.

Thorax.—The pericardium contained a small quantity of yellow fluid; there were several pericardial hæmorrhages. The heart was normal but contained an ante-mortem clot in the left ventricle. The lungs at both bases were in a state of hypostatic congestion.

Abdomen.—The peritoneum was stained yellow. The stomach contained about six ounces of black fluid; it was deeply congested, as was the duodenum. Along the lesser curvature and at the pylorus were several extravasations of blood. The liver was much enlarged, of a pale yellow colour, the gall bladder was empty, the spleen was normal, as were all the other viscera with the exception of the kidneys, which were congested. The bladder was empty. Smears and sections of the organs were made. The liver showed advanced fatty degeneration and the kidneys acute tubular nephritis. No malarial parasites were seen. Three round worms were found in the stomach and five in the small intestine.

59. Sheba Roland, aged 24, black. History: She lived with her aunt (Case 58) and on Saturday morning early went to the market at Falmouth. She then appeared to be in her usual health. Early in the morning she began to feel sick. She had no desire to vomit, no pains, but " felt weak." About 11 o'clock she decided to return home. On the way she says she " felt fever "; she had no rigor but suffered from severe headache. A couple of miles out of Falmouth she had to sit down, she then vomited once or twice. She was so weak that her companions had to carry her home. About 8 o'clock she had a severe attack of vomiting. On Sunday she had " fever," but felt a little better. On Monday vomiting continued and she vomited frequently. On Tuesday her condition was much the same. On Wednesday she felt a little better and the " fever " was much less. When I saw her on Thursday she was very weak, the temperature sub-normal, pulse 80, the liver was enlarged and tender, the spleen was not palpable, there was epigastric pain and tenderness. The urine contained a small amount of albumen. Blood smears showed no malarial parasites and the cultures were negative. She had no return of the fever and was convalescent in about 10 days. At no time was there any jaundice, and a specimen of urine examined on the 11th still contained a trace of albumen.

Passed three round worms on 10th March, 1911.

60. 9th March, 1911.—Adora Chambers, aged 21, black, half-sister to Sheba Roland, living with her mother in the house to which Sheba was brought. She complained of " bad feelings in the belly " on Tuesday, the 7th. She did not vomit and she had no " fever." She said she felt the same way on Wednesday. Seen on Thursday. Temperature was 99°, pulse 100, complained of epigastric tenderness, there was no enlargement of the liver, the spleen was not palpable, the urine free from albumen. Blood smears showed no malarial parasites. Blood culture was not made. She recovered.

61. 9th March, 1911.—Mary Smart, aged 14, black, another half-sister of Sheba Roland. She said that she felt ill on Sunday. She had " bad feelings in the belly and chest " and " a little fever." She said she felt the same way on Monday, Tuesday, and Wednesday. On Thursday when I saw her, her temperature was normal, pulse 114, the liver and spleen normal, there was no epigastric tenderness, the urine was free from albumen. Blood smears showed no malarial parasites and a blood culture was not made. She recovered.

62. 10th March, 1911.—Katie Campbell, aged 23, black, Refuge: seen with Dr. Purchas, who said it was a typical case. She stated that she was quite well till the morning of the 7th, when she awoke with " fever," headache, and pains in the back. She was too ill to get up and stayed in bed. The fever continued on the 9th. On the morning of the 10th she vomited " yellow phlegm." She had vomited

four times between day-break and 8.30. The vomited matter consisted of bile-stained mucus. The liver was enlarged and tender. There was epigastric tenderness, the spleen was not palpable. The temperature was 99°, the pulse 120. The urine contained no albumen. On the 11th her temperature was 99°, pulse 100. The vomiting still continued, and whilst there I saw her vomit once. It consisted of bile-stained mucus with a few specks of blood. The bowels had been moved during the night and the motion contained some blood. (She was not suffering from hæmorrhoids.) The urine contained no albumen. 12th: The vomiting was somewhat better, she had noticed no blood in it. The temperature was 99·6°, pulse 96. The urine contained a trace of albumen and she had passed a motion which contained some more blood; this I did not see. Seen again on the 14th. Vomiting had ceased, her temperature was sub-normal, pulse 90, urine contained a trace of albumen. There had been no more hæmorrhage from the bowels. She had not menstruated. She slowly recovered. There was at no time any jaundice and her pulse never fell below 80.

63. 10th March, 1911.—Isabel Sutton, aged 25, black, Calabar, reported as a case of Vomiting Sickness. Was said to have fever on the morning of the 9th; about day-break on the morning of the 10th she complained of " bad feelings in the belly," and soon after vomited. The vomited matter was said " to have been yellow phlegm." She vomited three or four times before noon, when I saw her. Temperature was normal, pulse 110. There was some epigastric pain and tenderness. The liver was enlarged to about two inches below the costal margin. The spleen was not enlarged. Blood smears showed no malarial parasites and blood cultures were negative. On the 11th her temperature was normal, pulse 100. She had not vomited since 4 o'clock on the 10th. The liver was still enlarged. The epigastric tenderness was still present. The bowels had been opened. Urine was free from albumen. Seen on the 13th, temperature was normal, pulse 80, blood smears again negative, and the liver was less tender and not so enlarged. She said she had had no more " fever."

64. 11th March, 1911.—Cleveland Sue, aged 16, a half-caste Chinese and negro boy, at Crawle, reported as a case of Vomiting Sickness, seen with Dr. Purchas, who said it was a typical case. History: on the morning of the 10th he had " fever " (no history of a rigor), headache, pains in the back, but felt no inclination to vomit. On the morning of the 11th, about daybreak, he vomited twice. At the time of my visit, at 9 a.m., he was retching, complained of abdominal pain; there was tenderness over the liver, the spleen was not enlarged. The tongue was dry and coated with a brown fur, but red at the tip and edges. Temperature 102°, pulse 100, urine free from albumen. 12th: the temperature 102°, pulse 104. He had vomited three or four times during the night. Friends said the vomit was " green." He vomited while I was present, the vomit consisting of bile-stained mucus; the liver was still enlarged and tender, the urine was free from albumen. 13th: temperature 100°, pulse 96; he had vomited twice during the night, the vomit was said to have been " yellow "; the urine was free from albumen. 15th: temperature was normal, pulse 90, urine free from albumen; there had been no more vomiting. He said he felt well, and quickly recovered.

65. 11th March, 1911.—A. L. Edwards, 9 10/12 years, black girl, Dry Hill. The case was reported as one of Vomiting Sickness. History: She returned from her father's " ground " apparently in good health on Friday evening. The distance to the " ground " was some 7 miles; this she walked. She got up to light the fire next morning about daybreak; she helped to prepare the breakfast, which was ready about 7 o'clock. She then said she felt ill, and did not take any breakfast. She complained of abdominal pain; about 8 o'clock she vomited and became unconscious about 10. I saw her at 11.15 a.m. Temperature 96°, pulse 120. She was quite unconscious, pupils contracted. She vomited some frothy, blood-stained mucus. Blood smears were taken. These showed no malarial parasites. I saw her again at 5 o'clock. Her condition was much the same. She was reported to have had " fits." A sample of urine obtained contained no albumen. Pulse was imperceptible and temperature 96°. The liver was distinctly enlarged. The spleen could not be felt. She died during the night. Post-mortem examination the following morning at which Dr. Purchas was present.

Thorax.—The lungs were in a state of hypostatic congestion. The trachea and

bronchi full of frothy, blood-stained mucus. The pericardium and heart were normal.

Abdomen.—The stomach was intensely congested, particularly along the lesser curvature. It contained some blood-stained mucus. The liver was enlarged, of a purple colour, showing yellow mottling. On section this was more marked. The intestines normal. There were no intestinal parasites. Kidneys were congested. The bladder was empty, the other organs were healthy. It was stated by the mother that the previous month she had been given a worm powder, and passed one round worm. The father, when questioned, said he did not think she had fever whilst out at the "ground," where she had been from the previous Tuesday, as she "appeared hearty" and took her food. Smears and sections of the organ showed no malarial parasites. The liver cells were in a state of cloudy swelling. (Lived opposite Elsada Sutherland, Case 23.)

66. 14th March, 1911.—W. Scarlet, 1 year 3 months, male, black, at Sherwood, Falmouth District, reported as a death from Vomiting Sickness. History: the child had been quite well up to the previous evening. Before daybreak his mother heard him "choking." His mouth was full of blood-stained, frothy mucus. He vomited a little corn meal pap. He quickly became unconscious, had fits, and died about 8 o'clock. Post-mortem examination at 3 p.m. Body was that of a well-nourished infant. Brain and cord healthy.

Thorax.—The lungs in a state of hypostatic congestion. Trachea and bronchi filled with blood-stained mucus. Heart and pericardium normal.

Abdomen.—Stomach deeply congested. No actual hæmorrhages. Duodenum the same. The remainder of the intestine healthy, and contained no round worms. The liver was enlarged, the spleen normal, as were the other organs. Bladder contained a small quantity of urine which was free from albumen.

Smears and sections of the tissues showed no malarial parasites. This case was in the same district as Cases 58 and 59.

67. 15th March, 1911.—F. Watson, 26, female, black, residing at Calabar, was reported as a case of Vomiting Sickness. A well-nourished woman. Stated that she had been quite well until the morning of the 14th. She awoke with headache, pains in the back and abdomen. She vomited once or twice. When seen her temperature was 100°, sweating profusely. History of rigor that morning; pulse 120. There was some epigastric tenderness. The spleen was enlarged. Blood smears showed numerous malarial parasites, benign tertian, and she recovered on the administration of quinine. There was no albumen in the urine at any time.

68. 15th March, 1911.—Robert Mitchell, 13, black, Calabar. This boy is no relation to E. Mitchell, residing in Calabar—Case (57) reported on the 8th—nor could I obtain any history of his having frequented the same house or yard. His mother's house is situated about 400 yards from the house of Esther Mitchell. The case was reported as one of Vomiting Sickness. The boy was said to have been quite well until the morning of the 14th. He awoke with "fever" and pains in the abdomen. On the 15th the fever continued, and vomiting started during the night of the 16th. Condition when I saw him: he was a healthy, well-developed boy. Complained of severe headache, pains in the back, epigastric pain, and tenderness over the liver, which was enlarged to about an inch below the costal margin. Temperature 102°, pulse 100. He vomited while I was there. The vomit consisting of bile-stained mucus. On the 17th the temperature 102°, pulse 120; he had vomited three or four times; was then feeling better. I had been unable to obtain a specimen of urine the previous day, but it was now free from albumen. The 18th: temperature 101°, pulse 90. He had vomited twice during the night and once that morning. The tenderness over the liver and epigastrium still continued. The urine was free from albumen. On the 20th his temperature was normal, pulse 80; there had been no more vomiting, and he said he felt well. Blood smears taken at each visit showed no malarial parasites. The 23rd: seen again, he was quite well; the urine free from albumen, the pulse 84.

69. 23rd March, 1911.—J. Brown, aged 14, female, black, St. Anne's Bay. Reported as a case of Vomiting Sickness. The case had been seen by Dr. Joslen, who reported it as one of Vomiting Sickness. On arrival I found that the girl had been about half an hour dead. I made a post-mortem examination. History: Up to the night of the 19th she had been quite well—that night she suffered from headache

and fever, next day she suffered from fever and vomited on the 20th. On the 21st she was still suffering from fever, but does not appear to have vomited. On the 22nd she still had " fever," vomited several times, the vomited matter was said to have been yellow. The 23rd : She was very seriously ill in the morning. Temperature 102°, pulse 100. She was seen by Dr. Joslen, who recognised it as a case of Vomiting Sickness, and telegraphed to me.

Post-mortem examination : She was a very well-developed girl.

Thorax.—On section the tissues were yellow. Pleuræ normal, lungs in a state of hypostatic congestion, contained some blood-stained, frothy mucus. Pericardium : There was some sub-pericardial hæmorrhages. The right side of the heart contained a ante-mortem clot extending into the pulmonary artery.

Abdomen.—The liver was much enlarged, of a pale yellow colour, and on section the colour was even lighter. The gall bladder was not distended. Stomach deeply congested throughout, and contained a few ounces of mucus with some streaks of blood. The duodenum for about four inches from the pylorus was in the same condition. The remainder of the intestine was healthy. Two round worms were found in the small intestine. The spleen was not enlarged. The kidneys were congested. The other organs were normal. The bladder was empty. Smears and sections of the organs showed no malarial parasites. The liver was in a state of fatty degeneration, and the kidneys showed acute tubular nephritis.

70. Infant Brown, aged 2, female, black, sister to J. Brown, St. Anne's Bay, lived in the same house. Early on the morning of the 23rd the child was attacked with vomiting. She vomited first some foodstuff, later clear mucus. Became unconscious and died at 1 p.m. She is said to have had " fits " shortly before death. Post-mortem examination the same evening. The brain and cord not examined.

Thorax.—Lungs deeply congested, a round worm was found alive at the epiglottis. The trachea and bronchi were filled with frothy mucus, blood-stained. Heart and pericardium normal.

Abdomen.—The stomach was deeply congested, and contained coffee-ground matter and some blood-stained mucus. The other organs were healthy. Three round worms were found in the small intestine.

Smears of the spleen and liver showed no malarial parasites.

Two Cases seen with Doctor Turton at Stoney Hill, St. Andrew.

Iris Law, a healthy well-developed coloured child, said to have been in perfect health till 12.30 p.m. She then appeared to be drowsy. Said she was sick and vomited. After an interval of about an hour she became comatose. When I saw her about 4 o'clock with Dr. Turton she was quite unconscious. The temperature was sub-normal, the pupils contracted, pulse small and running. She had occasional attacks of vomiting, the vomit consisting of coffee-ground material, and was almost without effort. She died the same night. Post-mortem examination was made next morning. Brain and cord were normal, but with some very slight congestion of the meninges; the bases of both lungs were in a state of hypostatic congestion; the heart was normal, as was the pericardium.

Abdomen.—Stomach was deeply congested but there were no actual hæmorrhages; the duodenum was congested; small intestines were healthy but contained six round worms; the mesenteric glands were enlarged; the other organs were healthy except the kidneys, which were somewhat congested. Urine obtained from bladder was free from albumen.

R. Reid, a coloured boy, half-brother to Iris Law, aged 13. Whilst the first child, Iris Law, was lying ill Dr. Turton's attention was called to the half-brother who was sitting in the yard. He said that he " had bad feelings " and " felt inclined to be sick." He looked ill, but I was inclined to attribute this to fear. His temperature was normal, pulse 100. Dr. Turton, who has had much experience of the so-called " Vomiting Sickness," viewed his condition more seriously. He ordered him stimulants and had him put to bed. About midnight his grandfather was awakened by the boy, who was very ill, and was then vomiting. He vomited three or four times; the vomited matter was said to have been " like the sister's." He became unconscious about 2 o'clock a.m., and died at 4.40. Post-mortem examination made at about 10 the same morning. Brain and cord were normal.

Thorax.—Lungs in a state of hypostatic congestion at the bases, with ecchymosed patches at the margins of the lungs. Heart and pericardium normal.

Abdomen.—The stomach deeply congested contained some mucus and a small amount of coffee-ground matter. The duodenum was congested, the remainder of the intestine healthy but for the presence of a few round worms. The liver was slightly enlarged. The kidneys somewhat congested. The mesenteric glands were enlarged. The other organs normal.

Sections of the tissues showed no protozoal organisms.

Dr. Scott, the Island Bacteriologist, gives the following description of blood smears which he took from Iris Law about four hours after the onset of the first attack of vomiting. They were stained the following morning with Leishman's stain. He says, " I found in many of the red corpuscles an elongated protozoal-looking body which did not stain as a rule, though in some few instances a spot of stained substances was apparent at the end. In many cases, in fact in the majority of the corpuscles in which these bodies were seen, they were in pairs, occasionally set at an angle with one another, but sometimes parallel, the two segments being of unequal length. The longer was 4-4·5 microns long, the shorter 2-3 microns, and each was from 1-1·5 microns in breadth. In others the length was almost equal to the breadth, or again, in a few the shape was a slightly elongated oval. I showed them to Captain Potter on his return from the country district to which he had gone, and he was at first inclined to regard them as artefacts, but later on in another patient of 23 years of age, who recovered, I again found them. The smears in this last case were taken about the same time (three hours) after the onset, or at all events during the early comatose stage.

" I have examined several smears made later on in the disease, shortly before death, but have not been able to detect them."

Dr. Scott showed me his preparations. I regard the appearances as artefacts for the following reason :—In many fields the corpuscles were normal in appearance. In another field would be found several corpuscles in which the appearance would be of parallel rod, and in yet another part of the slide the appearance would be that of rounded or oval bodies, but in all cases the appearances in each field bore the same characteristics.

APPENDIX C. TO APPENDIX No. VII.

A few Cases taken from those in which a Post-mortem Examination has been considered necessary on Medico-legal Grounds.

6th March, 1898.—Lilian Frances, King Street, Spanishtown, St. Catherine. Tissues pale on section. Congestion of bases of lungs. Heart pale. Liver : colour not uniform, some areas looked natural, others distinctly pale and appeared due tc fatty change. On section cut surfaces presented a light straw colour. The substance was very friable. The stomach wall appeared to be slightly enlarged. Took ill on the 5th and died the same day. Cause of death, syncope and excessive vomiting.

26th May, 1906.—James Gordon, Camp, Savanah, Westmoreland; lungs congested. Heart flabby and filled with a heavy yellow clot. Valves were healthy, but the walls showed signs of degeneration, as is found after death from certain acute fevers. Stomach and intestines healthy. The liver was quite bloodless, of a pale yellow colour; on opening it was found to be in a degenerated condition. Death was certified to be due probably to remittent malarial fever.

24th January, 1907.—Charles Roberts, Clifton, St. Andrew; post-mortem examination.

Thorax.—Heart, small, empty, valves healthy. Lungs, some hypostatic congestion. Stomach contained a little tea. Intestines generally empty. Liver very large, pale yellow in colour, with patches of black pigment here and there. Spleen somewhat larger than normal. Bladder full of urine. Cause of death was chronic malaria aggravated by insufficient food and poor surroundings.

23rd February, 1907.—John Henderson, Springfield, St. James, taken ill on the 19th and died on the 22nd; cause of death was certified as excess of vomiting, causing syncope; also said to have been suffering from chronic Bright's disease.

Lungs congested. Heart shows extensive fatty degeneration. Liver pale, very marked fatty degeneration. Stomach and intestines normal. The wife stated "That her husband and daughter were quite healthy up to the 19th, when he was taken ill; he died on the 22nd."

Clementina Henderson was taken ill with the same vomiting on the 20th of February. She died on the 23rd. "I also lost one of my children on the 20th from the same Vomiting Sickness. Several of the same family died from the same Vomiting Sickness."

20th February, 1907.—David Forbes, Darliston. This case is given as one of ackee poisoning. Heart showed fatty degeneration. There were some patches of pericarditis. Lungs congested, punctiform ecchymoses beneath the pleuræ, hæmorrhage in the substance of both lungs. The stomach contained a good deal of dark liquid mixed with mucus. The mucus membrane was congested, and there were numerous small black points, evidently due to small capillary hæmorrhages. The liver was enlarged and had undergone complete fatty degeneration. The kidneys had also undergone the same change to a considerable extent. The other organs were normal. The bladder was empty.

3rd March, 1908. Temple Hall, St. Andrew's, Horiah Hector, 23 years of age, took ill on the 28th February, 1908, died on the 2nd March, 1908. Liver pale and greasy. Spleen somewhat large.

20th December, 1908. Herbert Campbell, Richmond, Manchester, 23 years of age; right lung congested, dark purple colour, solid on section, bled freely. The liver was enlarged and lemon-coloured. The stomach was enlarged, containing a fluid resembling milk. All the other organs were healthy. There was a history of vomiting from at least Saturday to Wednesday. Hæmorrhage before death. Cause of death was given as pneumonia.

15th December, 1909.—Esther Wells, aged 29, black, Seafield, Trelawney. There was a history of vomiting, and two other persons were said to have died on the premises two days before her death. Lungs and pluræ healthy. Right side of the heart contained an ante-mortem clot. The heart muscle was pale. The liver was considerably enlarged. It was pale yellow in colour for the most part. The spleen was enlarged. Each kidney showed a cyst and was large and pale. The stomach was inflamed. Bladder was full. There was pus in the right fallopian tube of long standing. Cause of death certified as chronic malarial poisoning.

26th December, 1909.—Clementina Walker, Norwich, Portland. Stated to have been taken ill on the train coming from Porus, Manchester, to Orange Bay Station on the 24th. Post-mortem: Rather marked indication of cerebral congestion but nothing to indicate inflammation. The lungs were congested. Heart contained anti-mortem clot. The liver was of a pale yellow colour; represented indications of rapid fatty degeneration. Spleen was congested. Kidneys congested. Bladder contained a quantity of urine. Stomach: There was extravasation of blood under the mucous lining near the cardiac end. Cause of death, "vomiting."

21st December, 1909.—Francilla Agatha Burrell, Oaks, Clarendon. Stomach contained an ounce of a dark coloured fluid. The mucuous membrane not diseased. The liver looked grey in colour and softened. Spleen firm and not enlarged. Other organs healthy. Took ill 17th December. Cause of death vomiting sickness.

9th January, 1910.—Felicia Bailey, Redbury, Manchester. Post-mortem: Lungs slightly congested. Heart somewhat soft. Liver very much enlarged of a pale lemon colour. Spleen greatly enlarged. Stomach dilated, lining membrane coated with mucus. Small intestine congested in patches. Taken ill on the 31st December, died on the 8th January. Vomiting, passing up worms. Cause of death, syncope from malarial fever.

24th May, 1910.—J. Brown, Dalney, St. Thomas. Lungs congested. Old pleurisy left side. Heart enlarged and dilated. Spleen much enlarged. Liver also very much enlarged. Showed extensive fatty degeneration. Kidneys congested. The stomach and upper part of the intestine congested. Vomit greenish and contained a little blood. Took ill on the 21st May, died on the 24th. Cause of death, remittent malarial fever.

APPENDIX D. TO APPENDIX No. VII.

On Cases said to be Vomiting Sickness.

17the February, 1911.—Reported by Dr. Purchas. A. R. Clark, aged 13, female, black, a well-nourished girl, became ill on the 17th at 6 a.m., had no pain, vomited twice that day. Was in a listless condition on the 18th; was much the same; became semi-unconscious on the morning of the 19th. Quite unconscious about 2 p.m., and died at 4 p.m.

Stomach congested. Mucous membrane covered with mucus. Hæmorrhage in various places on mucous membrane. Liver Bright brick colour and enlarged. Kidneys congested.

1st March, 1911.—John Graves, aged 10, black, a healthy boy, went to his father's grounds on the 1st of March, about six miles from his house. Shortly after he felt weak and bad. The boy remained in a semi-unconscious state till about 12 midnight, when he died.

Post-mortem : Stomach congested, contained about four ounces of a black-looking liquid. Liver mottled. Kidneys congested.

7th March, 1911.—Three cases, described by Dr. G. W. Thompson. Ida McPherson, aged 6½ years, Blue Hole, Mont Pelier. Child said to have been quite well up to the morning of the 9th February. Vomiting lasted all day. She became comatose, and died at 2 a.m. on the 10th. Body well-nourished. All organs healthy, except kidneys—remarkably congested. Bladder empty. Numerous round worms.

9th March, 1911.—Rebecca McPherson, aged 13 years, sister to above, quite well on the morning of the 10th, when she went to Montego Bay to inform a sister of Ida's death. On returning was attacked with vomiting which continued during the night. She died at 8 a.m. on the 11th. All the organs healthy, except kidneys—markedly congested, bladder empty, and no worms.

Ivaline Cross, aged 2 years and 9 months, niece of the preceding two cases, lived in the same house. Quite well up to the morning of 15th February. She began to vomit. Vomiting continued through the day, and she died at 4 p.m. All organs healthy. Kidneys markedly congested. No worms.

20th February, 1911.—In three cases reported by Dr. Johnson, he remarks that the liver is enlarged, and with yellow mottling or yellow spots.

5th February, 1911.—Five deaths were reported from Moneague. The District Medical Officer found them all lying dead—a mother and four children. In the same room another woman and an infant were apparently dying. These he treated with stimulants, and they recovered. He considered the deaths as having been due to Vomiting Sickness, though he said that he had no previous experience of the disease. Subsequently, one of these bodies was exhumed, as the suggestion had been made that death was due to eating a yam which had been poisoned with arsenic. Arsenic was found in the organs of the body which had been exhumed. None of the other bodies were exhumed, and the jury found, in accordance with the medical evidence, that the cause of death was Vomiting Sickness.

Another Group.

Another group of cases was reported by the same medical officer in April. A mother and six children stated to be suffering from Vomiting Sickness. They were all attacked about two hours after partaking of a meal of salt fish and yams. They responded readily to stimulant treatment. Purging in addition to vomiting was a marked symptom. They were all quite well the following day. It will be noticed in both these sets of cases that all those who partook of the same meal were attacked shortly afterwards, and that all the partakers of the meal were attacked. On enquiry from the police a history was obtained of two other families in Clerement having been attacked with vomiting and purging on the same day as the last group. They had also partaken of salt fish, which was said to have been bought in the same shop as that in which the fish used by the previous family had been bought. These cases were not reported to the District Medical Officer, and all had recovered by the next day.

Dr. Johnstone, Adelphi, reported five cases of Vomiting Sickness. The history was as follows :—

Andrew Thomas, residing at Orange, St. James, his wife and three children, aged 17, 7, and 2. The three children became ill on the morning of the 19th. The youngest child died the same evening. The father and mother attacked on the morning of the 20th. In their case there was no pain, no headache, but felt weak. The father recovered after two hours, but the mother and the two surviving children continued vomiting. On Saturday afternoon the father obtained medicine from Dr. Johnstone, which stopped the vomiting promptly in all three cases. The child aged 7 died at 5.45 on the morning of the 22nd January.

Post-mortem.

Thorax.—No appearances calling for special note.

Abdomen.—Large and small intestines almost empty but for about one dozen round worms, and apparently normal, although very pale looking. Stomach : Pale, some dilated capillaries along lesser curvature. Mucosa practically normal. Spleen small, firmer than normal. Liver much enlarged, firm, smooth, surface mottled with pale areas. Cut surface yellow (resembling fatty liver). Gall bladder distended with green bile containing thick mucus. Kidneys firm, nodular, pale, but healthy-looking on section. No other abnormal appearances noted.

APPENDIX E. TO APPENDIX NO. VII.

Case.	Liver.	Tissues.	Stomach.		Kidneys.	Spleen.
			Contents.	Mucosa.		
8	Light yellow ...	Yellow	Clear, with black specks floating in it.	Congested and hæmorrhagic.	Congested	Normal.
12	Purple, with light yellow areas.	Yellow	Specks of blood ...	Hæmorrhages into the wall.	Congested	Normal.
13	Enlarged, yellow areas.	—	Clear	Hæmorrhages into wall.	Normal ...	Normal.
31	Enlarged, purple, light areas.	—	—	Congested	Normal ...	Normal.
32	Enlarged ...	—	—	Hæmorrhages ...	Congested	Normal.
35	Light yellow ...	Yellow	Clear, with black specks floating in it.	Hæmorrhages at pyloric end and lesser curvature.	Congested (old pus in left).	Normal.
40	Enlarged ...	—	Coffee-ground matter.	Congested and hæmorrhagic.	Normal ...	Normal.
41	Enlarged, purple	—	Coffee-ground matter.	Congested	Normal ...	Normal.
42	Enlarged, yellow mottling.	—	Blood-stained mucus	Hæmorrhages at pyloric end.	—	Normal.
47	Pale yellow, enlarged.	—	Coffee-ground matter and some specks of blood.	Congested hæmorrhages along lesser curvature.	Congested	Normal.
48	Enlarged, purple	—	—	Deeply congested ...	Congested	Normal.
56	Enlarged, purple, mottled.	—	Coffee-ground matter.	Deeply congested ...	Congested	Normal.
58	Enlarged, pale yellow.	Yellow	Black-fluid ...	Congested hæmorrhages at lesser curvature and pylorus.	Congested	Normal.
65	Enlarged, purple, yellow mottling.	—	Blood-stained mucus	Congested	Congested	Normal.
66	Enlarged ...	—	—	Deeply congested ...	Normal ...	Normal.
67	Enlarged, pale yellow.	Yellow	Mucus and blood ...	Deeply congested ...	Congested	Normal.
70	Normal	—	Coffee-ground matter and blood-stained mucus.	Deeply congested ...	—	—

APPENDIX F. TO APPENDIX NO. VII.

Case No.	Erythocytes.	H.B.	Total.	Leucocytes.		Lymphocytes.	Eosionophiles.
				Polymorpho-neucleears.	Large mononeu-clears includ-ing trans.		
3	4,300,000	80	9,500	68·5	7·5	20	4
4	4,400,000	70	6,000	61·75	14·25	22·5	4·5
5	4,700,000	80	7,300	59·5	9·5	27·25	3·75
9	5,000,000	80	4,400	43·5	17·5	38·5	1·5
10	4,400,000	83	3,400	50·25	17·75	29·25	1·75
17	3,500,000	50	5,000	62·5	15·5	21·75	0·25
18	4,100,000	65	6,400	68·5	11·5	19·0	0·0
19	4,300,000	70	6,100	65·25	9·75	23·5	1·5
23	4,400,000	75	5,200	70·5	8·5	20·5	0·5
24	4,800,000	80	6,000	69·25	8·75	21·75	0·25
25	4,500,000	72	3,000	67·5	14·5	17·5	0·5
26	4,300,000	75	7,000	60·5	11·5	56·25	1·75
27	4,400,000	75	6,000	70·5	19·5	16·0	0·0
31	—	—	—	50·5	17·5	22·0	10·0
32	—	—	—	45·5	12·0	33·5	8·0
35	4,300,000	70	4,500	55·5	10·5	34·0	0·0
39	4,700,000	80	5,000	43·25	16·75	37·5	2·5
40	4,900,000	80	3,500	53·5	17·5	29·0	0·0
41	—	—	—	57·25	15·75	25·0	1·0
42	—	—	—	50·5	21·0	28·5	0·0
43	5,000,000	75	4,500	44·5	14·5	40·5	1·5
44	—	—	—	75·5	7·5	11·0	0·0
45	4,400,000	80	4,000	67·25	13·75	17·5	1·5
46	4,800,000	75	4,200	53·5	15·5	29·5	1·5
48	—	—	—	60·25	13·75	24·5	1·5
49	—	—	—	70·5	6·0	23·5	0·0
50	—	—	—	68·5	10·0	22·0	0·0
53	—	—	—	60·5	6·0	19·5	14·0
54	—	—	—	63·5	7·5	22·5	6·5
55	—	—	—	64·5	8·5	25·5	1·5
58	—	—	—	54·5	15·5	27·0	2·0
59	4,300,000	70	4,100	55·5	14·5	26·5	3·5
60	—	—	—	65·5	7·0	26·5	1·0
61	—	—	—	66·0	8·0	26·0	0·0
62	4,100,000	—	3,500	50·5	10·5	37·25	1·75
63	—	—	—	51·5	12·5	32·5	3·5
64	—	—	—	56·5	10·5	33·0	0·0
65	4,600,000	68	3,200	66·5	15·5	18·0	0·0
67	4,300,000	70	4,000	65·5	11·5	23·0	0·0
69	—	—	—	54·0	16·0	29·5	0·5
70	—	—	—	50·0	18·0	30·5	1·5

TROPICAL DISEASES RESEARCH FUND.

REPORT

OF THE

ADVISORY COMMITTEE FOR THE TROPICAL DISEASES RESEARCH FUND

FOR THE YEAR 1913.

(*For Report for* 1912 *see* [*Cd.* 6669] *March*, 1913.)

Presented to both Houses of Parliament by Command of His Majesty.
March, 1914.

LONDON:
PRINTED UNDER THE AUTHORITY OF HIS MAJESTY'S STATIONERY OFFICE
By DARLING AND SON, LIMITED, BACON STREET, E.

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1914.

[Cd. 7261.] *Price* 2*s*. 4*d*.

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Serial No.	From or to whom.	Colony, &c.	Date.	Subject.	Page.
			1913.		
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REPORT

OF THE

ADVISORY COMMITTEE

FOR THE

TROPICAL DISEASES RESEARCH FUND

For the Year 1913.

REPORT.

The Advisory Committee for the Tropical Diseases Research Fund was constituted by the Secretary of State for the Colonies in July, 1904. It is now composed as follows:—

The Right Honourable Sir J. West Ridgway, G.C.B., G.C.M.G., K.C.S.I., P.C., LL.D. (Chairman);
Sir Thomas Barlow, Bart., M.D., K.C.V.O.;
Sir John Rose Bradford, M.D., D.Sc., K.C.M.G., F.R.S.;
Surgeon-General Sir David Bruce, C.B., F.R.S.;
Surgeon-General Sir R. Havelock Charles, G.C.V.O.;
Mr. F. C. Drake;
Sir Patrick Manson, M.D., G.C.M.G., F.R.S.;
Mr. H. J. Read, C.M.G.;
Major Sir Ronald Ross, K.C.B., F.R.S.;
Mr. J. A. C. Tilley;
Mr. A. Berriedale Keith, D.C.L. (Secretary).

Surgeon-General Sir A. M. Branfoot, K.C.I.E., I.M.S., who had been a representative of the India Office since 1904, resigned his membership on his retirement from the India Office, and the Committee desire to place on record their high appreciation of the constant interest which he took in the work of the Committee and the services which he rendered.

The revenue of the Tropical Diseases Research Fund for the year 1913 was made up as follows:—

Contribution from the Imperial Government	£1,000	
Contribution from the Government of India	500	
Making a total of	£1,500	
Contributions from Dominion and Colonial Governments in the following proportions:—		
Commonwealth of Australia	£200	
Southern Nigeria	350	
Gold Coast	200	
Ceylon	100	
Straits Settlements	100	
Federated Malay States	100	
Hong Kong	100	
Trinidad	100	
Jamaica	100	
Fiji	100	
Sierra Leone	100	
The Gambia	100	
British Guiana	100	
Zanzibar	50	
British Honduras	50	
Grenada	50	
Leeward Islands	25	
St. Vincent	20	
Making a total of		£1,945
In all a total of		£3,445

The expenditure of the year was made up as follows:—

To the London School of Tropical Medicine	£1,200
To the Liverpool School of Tropical Medicine	1,200
To the University of London	750
To the University of Cambridge	450
Making a total of	£3,600

The excess of expenditure over income was met, as in the previous year, by drawing on the accumulated balance of the Fund, and the Committee desire again to place on record the importance of increasing the amount at their disposal, having regard to the large number of directions in which important research could be carried on if the means at their disposal could be permanently increased. In view of the demands on the Fund the Advisory Committee gave careful consideration to the possibility of reducing the grants made to the London and Liverpool Schools of Tropical Medicine, having regard to the fact that the London School would benefit under the Mansion House Fund, raised on the initiative of Mr. Austen Chamberlain for the purpose of providing an endowment for the School, and to the fact that the Liverpool School of Tropical Medicine was likely to benefit largely under the terms of the will of the late Sir Alfred Jones. The London School pointed out, however, that from Mr. Chamberlain's Fund, which included the Wandsworth Bequest, would have to be defrayed the cost of the new buildings of the School and of the maintenance of a certain number of beds for tropical cases and for research. They laid stress on the difficulty of maintaining skilled research workers, such as a helminthologist, a protozoologist, and an entomologist, if the grants made from the Tropical Diseases Research Fund were not continued.

The Liverpool School pointed out that the money which they would receive from the estate of the late Sir Alfred Jones was to be expended on building purposes: that the School had incurred large expenditure in despatching Dr. Seidelin on an expedition to Jamaica to study vomiting sickness and other diseases, and that the grant from the fund was urgently necessary for encouraging research work. It was accordingly decided after careful consideration to fix the grants to both Schools at £1,200.

The grant to the London School of Tropical Medicine was expended in respect of the salaries and the maintenance of the laboratories, of the teachers and investigators of helminthology, protozoology, and entomology.

Of the grant to the Liverpool School of Tropical Medicine £500 was spent on the research work on trypanosomiasis at the research laboratories of the School, £250 was devoted to research work on parasitology and helminthology, £250 to research work on entomology, and £200 to research work on malaria.

The grant to the University of London (£750) was expended in paying the salary of the Professor of Protozoology, whose post was established in 1906 for a period of five years by means of a grant from the Fund, and whose tenure of office was extended for another five years from 1911 on the recommendation of the Advisory Committee.

Of the grant to the University of Cambridge (£450), £120 was paid in respect of the Research Studentship in Medical Entomology established in 1907 by means of a grant from the Fund, £100 was paid towards the salary of an assistant in the Quick Laboratory, £100 towards the payment of a helminthologist to work in the Laboratory, £50 for the salary for a Consulting Entomologist, and £100 towards the general expenses of the Quick Laboratory. The grant represented an increase of £100 on the preceding year, which, in the opinion of the Committee, was amply justified in view of the importance and extent of the research work which is carried on by Professor Nuttall and his assistants.

As in 1908-12, no grant was made to the Royal Society from the Fund, other provision having been made for the carrying out of the research with regard to sleeping sickness, which is being continued under the general supervision of the Society.

The Committee were consulted on various matters during the year by the Secretary of State, including the important question of the measures to be taken to safeguard India and the Eastern Colonies against the danger of the introduction of yellow fever on the opening of the Panama Canal.

The Committee append to their report reports received from certain Colonies

and Protectorates in accordance with the request contained in the Secretary of State's circular despatch of the 20th of December, 1910, which is reprinted in this report, asking for the supply of statistical and other information with regard to mosquito-borne diseases. These reports embody a brief account of the anti-malarial measures taken in the different Colonies and Protectorates. The Committee attach the greatest importance to the regular supply of these reports and to care in their preparation, and they desire to call special attention to the excellent nature of the reports from Southern Nigeria and the Straits Settlements.

The Committee also append reports of the work done at the London and Liverpool Schools of Tropical Medicine for the year November, 1912, to October, 1913; the report of the Professor of Protozoology in the University of London for the year ended June, 1913; reports on the work done at various Colonial laboratories which have been sent in accordance with a request made by the Secretary of State for the Colonies in December, 1906; and a report by Professor Nuttall on the work done in the Quick Laboratory. The Committtee have recorded their sense of the importance of the work which is now carried out in the Colonial laboratories.

The reports from the laboratory maintained by the Governments of the West African Dependencies at Yaba and from the laboratory maintained by the Government of the East Africa Protectorate at Nairobi, are not reprinted, as they are published separately.

WEST RIDGEWAY.

A. Berriedale Keith,
16th March, 1914.

APPENDIX I.

Reports on Anti-Malarial Measures in the Crown Colonies and Protectorates, &c.

The following are the returns asked for in the Secretary of State's despatch of 20th December, 1910*:—

(Draft) Return of Malarial Fever, Blackwater Fever, Yellow Fever, Filariasis, and Dengue during the year from the 1st January to the 31st December (1910).

1. Name of Colony.
2. Total area.
3. Estimated population:—
   (*a*) Total.
   (*b*) Europeans.
   (*c*)
   (*d*) Other races.
   (*e*)
4. Births during the year:—
   Total births.
5. Deaths during the year:—
   (*a*) Total deaths.
   (*b*) Deaths ascribed to fever.
   (*c*) Deaths ascribed to blackwater fever.
   (*d*) Deaths ascribed to yellow fever.
6. Government Hospitals—
   (*a*) Number of such hospitals.
   (*b*) Totals, during year { admissions. deaths.
   (*c*) Malarial fever { admissions. deaths.
   (*d*) Blackwater fever { admissions. deaths.
   (*e*) Yellow fever { admissions. deaths.
   (*f*) Filarial Diseases { admissions. deaths.
   (*g*) Dengue { admissions. deaths.
7. Government Dispensaries:—
   (*a*) Number of such dispensaries.
   (*b*) Total attendances during year.
   (*c*) Attendances for malaria.
   (*d*) Attendances for filarial diseases.
   (*e*) Attendances for dengue.
8. Medical Service:—
   (*a*) Number of Government Medical Officers.
   (*b*) Number of special Health Officers.
   (*c*) Number of other registered practitioners.
9. Schools:—
   (*a*) Number of Government and State-Aided Schools.
   (*b*) Number of scholars registered in these schools.
   (*c*) Percentage of daily attendances.
10. Estates employing indentured labour:—
   (*a*) Number of such.
   (*b*) Number of indentured labourers employed.
   (*c*) Number of hospitals and dispensaries on such estates.
   (*d*) Total deaths among such labourers.
   (*e*) Deaths ascribed to malaria.
   (*f*) Total admissions and attendances at hospitals and dispensaries.
11. Estimated revenue of Colony:—
   Total during year.

* No. 11 in Appendix I. to [Cd. 5514].

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

12. Estimated expenditure of Colony:—
    (*a*) Total during year.
    (*b*) Annual medical and sanitary expenditure.
    (*c*) Upkeep of Government hospitals and dispensaries.
    (*d*) Total salaries and allowances of medical officers.
    (*e*) Total annual sanitary expenditure.
13. Towns under Municipalities or Town Councils:—
    (*a*) Number of such.
    (*b*) Total population.
    (*c*) Total revenues.
    (*d*) Total medical and sanitary expenditure.
14. Table of deaths by Districts:—

District.	Area.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total															

15. Table of deaths in the principal towns:—

Town.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total															

16. Rainfall during the year:—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total														

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

17. Additional information to be given if possible on the following points:—
   (*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Numbers of notices, convictions, and warnings during the year.
   (*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does Kala-azar exist?
   (*c*) Number of persons examined for filarial diseases. Where this was done? Percentage affected.
   (*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost.
   (*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.
   (*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed.
   (*g*) Is quinine distributed regularly in the schools?
   (*h*) Measures taken against these diseases on estates employing indentured labour.
   (*i*) Any steps taken regarding the housing of the poor.
   (*j*) Any exceptional increase or decrease of these diseases recently noticed.
   (*k*) Any other remarks on the subject.

No. 1.

HONG KONG.

REPORT FOR THE YEAR 1912 ON THE PREVENTION OF MOSQUITO-BORNE DISEASES.

(Received 5 May, 1913.)

1. Hong Kong.

2. Area: Island of Hong Kong, 32 square miles. Kowloon, 16 square miles. New Territories, 356 square miles (not included under any of the following statistics—wholly agricultural).

3. Census population (May 20th, 1911):—

Europeans	10,708
East Indians	4,066
Chinese and Malays	354,739
Mixed and coloured	3,608
Total	373,121

Estimated population to June 30th, 1912, 377,183.

4. Births:—Non-Chinese, 343. Chinese, 2,328.

5. Total deaths, 9,682. Deaths ascribed to malarial fever, 431. Deaths ascribed to blackwater fever, 0. Deaths ascribed to yellow fever, 0.

6.—(*a*) Civil Hospital (Government):—

Total admissions for the year, 2,731.

Total deaths for the year, 194.

Malarial fever:—	
Admissions	196
Deaths	4
Blackwater fever:—	
Admissions	0
Deaths	0
Yellow fever:—	
Admissions	0
Deaths	0
Filarial diseases:—	
Admissions	0
Deaths	0

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Dengue :—

Admissions	12
Deaths	0

(*b*) Victoria Hospital (Government) :—

Total admissions for the year, 234.
Total deaths for the year, 3.

Malarial fever :—	
Admissions	32
Deaths	1
Blackwater fever :—	
Admissions	0
Deaths	0
Yellow fever :—	
Admissions	0
Deaths	0
Filarial diseases :—	
Admissions	0
Deaths	0
Dengue :—	
Admissions	0
Deaths	0

No other Government Hospital other than the Infectious Disease Hospital. The following hospitals are supported by voluntary contributions :—

(*c*) Tung Wah Hospital (Chinese)—

Total admissions for the year, 4,278.
Total deaths for the year, 1,459.

Malarial fever :—	
Admissions	368
Deaths	125
Blackwater fever :—	
Admissions	0
Deaths	0
Yellow fever :—	
Admissions	0
Deaths	0
Filarial diseases :—	
Admissions	0
Deaths	0
Dengue :—	
Admissions	0
Deaths	0

(*d*) Alice Memorial and affiliated hospitals (for Chinese) :—

Total admissions for year, 1,472.
Total deaths for year, 85.

Malarial fever :—	
Admissions	26
Deaths	1
Blackwater fever :—	
Admissions	0
Deaths	0
Yellow fever :—	
Admissions	0
Deaths	0
Filarial diseases :—	
Admissions	0
Deaths	0
Dengue :—	
Admissions	0
Deaths	0

(*e*) Kwong Wah Hospital (Chinese), Kowloon:—

Total admissions for the year, 1,225.
Total deaths for the year, 536.

Malarial fever:—	
Admissions	143
Deaths	45
Blackwater fever:—	
Admissions	0
Deaths	0
Yellow fever:—	
Admissions	0
Deaths	0
Filarial diseases:—	
Admissions	2
Deaths	0
Dengue:—	
Admissions	0
Deaths	0

7. There are no Government dispensaries, but there are native (Chinese) dispensaries, supported by voluntary contributions and in charge of Chinese doctors trained in western medicine. Returns herewith:—

(*a*) Number of such dispensaries, 8.
(*b*) Total attendances during the year (new cases only), 47,719.
(*c*) Attendances for malaria (new cases), 3,747.
(*d*) Attendances for filarial diseases, 0.
(*e*) Attendances for dengue, 0.

8. Number of Government medical officers, 11.
Number of special health officers (including two for the port), 4.
Number of other registered practitioners (inclusive of military and naval medical officers), 29.

9. Schools:—
(*a*) Number of Government schools, 12.
,, State-aided schools, 51.
(*b*) Number of scholars registered in Government schools, 2,494.
,, ,, ,, State-aided schools, 5,382.
(*c*) Average daily attendance in Government schools, 1,987.
,, ,, ,, State-aided schools, 4,064.

10. Estates employing indentured labour, none.

11. Estimated revenue of the Colony	$7,677,488
12. Estimated expenditure of the Colony:—	
(*a*) Total	7,852,678
(*b*) Annual medical expenditure	$237,595
Annual sanitary expenditure	341,096
Total	$578,691
(*c*) Upkeep of Government Hospitals:—	
Salaries (including Bacteriological Institute)...	£161,386
Upkeep of hospitals	73,264
,, ,, Bacteriological Institute	2,945
Total	£237,595
(*d*) Total salaries and allowances of medical officers (including Sanitary Department and Bacteriological Institute)	£86,552
(*e*) Total annual sanitary expenditure	341,096

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13. No town under municipal control.
14. Table of deaths by districts:—

—	Area in square miles.	Population, 1912, Estimated (including Army and Navy).		Total Deaths.												
		Chinese.	Non-Chinese.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Victoria and Peak	$4\frac{1}{2}$	225,500	10,418	467	577	493	710	926	740	555	441	454	423	362	414	6,562
Villages of Hong-Kong.	$27\frac{1}{2}$	15,550	956	24	30	28	42	40	44	49	72	61	40	36	60	526
Kowloon	16	68,900	6,714	164	138	194	158	325	289	161	103	102	103	114	127	1,978
Harbour	—	46,070	3,075	59	40	31	53	89	63	77	37	42	34	37	54	616
Total... ...	48	356,020	21,163	714	785	746	963	1,380	1,136	842	653	659	600	549	655	9,682

15. Victoria is the only town, and the figures are given in the foregoing table.
16. Monthly table of rainfall:—

Where observed.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in inches.
Kowloon Observatory ...	2·710	2·435	4·345	3·995	3·940	14·160	7·555	15·715	3·880	0·015	0·285	4·900	63·935

17.—(*a*) No further legislation has been introduced to prohibit the breeding of mosquitoes; a copy of the by-law in force was sent with the Report for 1910. During the past year fourteen convictions were obtained for breaches of this by-law, the fines amounting to $54.

(*b*) It has not yet been possible to make any spleen examinations in regard to children outside the various hospitals, for reasons given in the previous report. Kala Azar does not exist in the Colony.

(*c*) Filarial disease is uncommon in Hong Kong; frequent blood examinations are made in all the hospitals in search of these parasites.

(*d*) The training of nullahs in the vicinity of the city is still in progress, and during 1912 the sum of $27,225 was spent for this work. The total length of trained nullahs and cement channels built since the commencement of anti-malarial works in the Colony is 10·2 miles.

(*e*) The staff remains as in 1911. Nineteen Inspectors, who give their whole time to sanitary work, five rural Police, who act also as Sanitary Inspectors, and 170 interpreters, foremen, artisans, and coolies, whose whole time is occupied in house cleansing, disinfecting, clearing brushwood, and collecting receptacles for water from the hillsides and waste lands in the neighbourhood of dwellings, in oiling pools and other sanitary and anti-malarial work.

(*f*) The amount of quinine issued free during the year was as follows:—

Government Hospitals	2,000	ozs.
Tung Wah Hospital	214	„
Kwong Wah Hospital	60	„
Alice Memorial and affiliated hospitals	361	„
Public Dispensaries	596	„
Total	3,231	„

(*g*) Quinine has been regularly distributed during the year in certain schools in the most malarious part of the Colony.

(*h*) There are no estates employing indentured labour.

(*i*) The question of housing is dealt with in the Public Health and Building Ordinance—a copy of which was sent with the Report for 1910.

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(j) The total deaths from malaria during the past five years have been as follows:—

1908	499
1909	422
1910	591
1911	338
1912	431

The ratio per 1,000 of admissions to hospitals for malaria among the British troops during the past five years has been as follows:—

1908	256·0
1909	138·4
1910	177·0
1911	125·5
1912	84·0

while among the Indian troops the ratios were:—

1908	102·8
1909	54·3
1910	89·8
1911	31·8
1912	83·2

These ratios are necessarily influenced to some extent by the healthiness or otherwise (from a malarial point of view) of the last station occupied by our troops, and this especially applies to the Indian regiments; yet, on the whole, the military and police figures afford a most reliable indication of the steady decrease in the malaria infection of the Colony generally, as these persons are under constant medical supervision. The general civilian figures are complicated by various factors over which we have little or no control, the most important of which is the fluctuating nature of the population of this Colony, which adjoins the mainland of China, for nearly four thousand Chinese persons enter and leave Hong Kong daily. In addition to this steady daily interchange, the Colony experienced during 1911 and 1912 an abnormal influx of Chinese refugees, to the number of forty to fifty thousand, many of whom would be heavily infected with the malarial parasite. These people were driven to Hong Kong by the political unrest in China which ultimately led to the overthrow of the dynasty and the establishment of a Republican Government.

The last census was taken on May 20th, 1911, and the influx of refugees commenced in April of that year and continued until the end of the year, so that estimates of population based on the census figures must necessarily under-state the actual population. This explains the apparent increase in both the birth and death rates for 1912, for it has been assumed that the influx was of a more or less temporary nature, and the census figures have been used in calculating the population for the year. It is evident, however, from the great activity of the building trade during the past year, that many of these people intend to take up permanent residence in Hong Kong, for sufficient new houses for about six thousand persons have been completed during the year, practically every unoccupied house or flat has been taken, and most of the native dwellings have become considerably overcrowded. The building operations themselves also contribute to the spread of malaria by the aggregation of infected workmen on building sites which adjoin untrained nullahs, as explained in my Report for 1911.

Special classes are held in all the schools of the Colony for instruction in hygiene, which includes a description of the part played by mosquitoes in the transmission of malaria, and mosquito larvæ, in jars covered with mosquito-netting, are regularly supplied to all schools for demonstration purposes.

A considerable quantity of literature on this subject—both in English and Chinese—is also distributed yearly to the community.

FRANCIS CLARK, M.D., M.R.C.P., D.P.H.,
Medical Officer of Health

March 29th, 1913.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

No. 2.

MAURITIUS.

RETURN OF ANTI-MALARIAL MEASURES AND OF MOSQUITO-BORNE DISEASES, 1912.

(Received 25 October, 1913.)

1. Name of Colony : Mauritius.
2. Total area : 720 square miles.
3. Estimated population on 31st December, 1912 :—
   (*a*) Total population, 371,746.
   (*b*) General population, 108,543.
   (*c*) Indian population, 257,731.
   (*d*) Chinese population, 5,472.
4. Births during 1912, 13,209.
5. Deaths during 1912 :—
   (*a*) Ascribed to fever, 4,498 (malaria included).
   (*b*) Ascribed to fever (blackwater), nil.
   (*c*) Ascribed to fever (yellow), nil.
6. Government hospitals :—
   (*a*) Number, 14.
   (*b*) Admissions in 1912, 18,183. Deaths, 1,172.
   (*c*) Malarial fever : admissions, 2,321. Deaths, 30.
   (*d*) Blackwater fever, nil.
   (*e*) Yellow fever, nil.
   (*f*) Filarial diseases : admissions, 32. Deaths, 1.
   (*g*) Dengue, nil.
7. Government dispensaries :—
   (*a*) Number, 29.
   (*b*) Total attendances, 73,469.
   (*c*) Attendances for malaria, 20,008.
   (*d*) Attendances for filarial diseases, 27.
   (*e*) Attendances for dengue, nil.
8. Medical Service :—
   (*a*) Number of Government Medical Officers, 36.
   (*b*) Number of special Health Officers, 8.
   (*c*) Number of other registered practitioners, 29.
9. Schools :—
   (*a*) Number of Government and State-aided schools, 149.
   (*b*) Number of scholars registered in these schools, 21,509.
   (*c*) Percentage of daily attendances :—
      (i.) Government schools, 61.
      (ii.) Aided schools, 64.
10. Estates employing indentured labour :—
   (*a*) Number, 90.
   (*b*) Number of indentured labourers employed, 33,745.
   (*c*) Number of hospitals and dispensaries, 94.
   (*d*) Total deaths among such labourers, 838.
   (*e*) Deaths ascribed to malaria.*
   (*f*) Total admissions and attendances at hospitals and dispensaries.*
11. Estimated revenue of the Colony during the year 1912-13, Rs. 10,400,700.
12. Estimated expenditure of the Colony during the year 1912-13 :—
   (*a*) Total during the year, Rs. 9,924,455.
   (*b*) Annual medical and sanitary expenditure, Rs. 884,967.
   (*c*) Upkeep of Government hospitals and dispensaries, Rs. 410,910 (exclusive of repairs, additions, &c., to buildings, Rs. 25,300).
   (*d*) Total salaries and allowances of medical officers, Rs. 87,847.
   (*e*) Total annual sanitary expenditure, Rs. 349,467.
13. Towns under Municipalities and Town Councils :—
   (*a*) Number, 4 (Port-Louis, Curepipe, Quatre Bornes, and Beau Bassin, Rose Hill).

* This information is not yet available. Measures have been taken to supply it in future.

Appendix I.

(*b*) Total population, 80,909. (Census of 31st March, 1911).
(*c*) Total revenues, Rs. 636,532.
(*d*) Total medical and sanitary expenditure, Rs. 102,204.

14. Table of deaths in the Colony by districts, (*vide* Annexure A).
15. Table of deaths in the principal towns, (*vide* Annexure A).
16. Rainfall during the year, (*vide* Annexure B).
17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?

Under our Public Health Ordinance (No. 32, of 1894-95, Article 29 (*f*)), any accumulation of water injurious to health is punishable as a nuisance. A bill dealing specially with the subject is in course of preparation. An Ordinance providing for major anti-malarial works at the joint expense of Government and of the private parties benefited was passed this year (No. 15 of 1913), and another Ordinance providing for the clearing of beds and banks of rivers was passed in 1910 (No. 22 of 1910).

(*b*) Number of children examined for enlarged spleen?—12,621.
Where was this done?—In the Government schools.
Percentage affected?—24 per cent.
Does kala-azar exist?—No.

(*c*) Number of persons examined for filarial diseases?—None.

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost?

Anti-malarial works of a permanent character are being undertaken over the whole of the island costing Rs. 1,000,000 approximately. A sum of Rs. 150,000 has been authorised to be spent during the financial year 1913-14.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost?

139, at cost of Rs. 2,250 per mensem. A sum of Rs. 50,000 is spent annually on minor anti-malarial works.

(*f*) Amount of Government quinine sold or distributed gratis during the year 1912-13. Agencies employed?

No Government quinine is sold. 502 lbs. 7 oz. 65 grs. was distributed free within the year by specially appointed distributors and in the schools, where it is, as far as possible, regularly distributed.

(*g*) Is quinine distributed regularly in the schools?—(See (*f*).)

(*h*) Measures taken against these diseases on estates employing indentured labour?

Minor anti-malarial works were completed on the following estates :—Deux-Bras, St. Aubin, Bassin, Valetta, Beau Sejour, Belle Vue (Pilot), and Labourdonnais; and continued on Le Vallon, St. Hubert, Petite Rosalie, The Mount, and La Baraque estates. Works were begun on Beau Vallon and La Retraite estates.

(*i*) Any steps regarding the housing of the poor?—None.

(*j*) Any exceptional increase or decrease of these diseases recently noticed? The figures for malaria show an increase.

(*k*) Any other remarks on the subject?

As briefly stated in the above answers, the plan of a general anti-malarial campaign has been prepared, and works of a permanent character started, particularly in the district of Pamplemousses. Rivers are being canalised and cleaned, marshes reclaimed, and objectionable collections of stagnant water removed. Works of a minor character continue to be carried on, such as filling in of hollows and water-holes, cleaning of canals, trenches, &c. Quinine is distributed free to all those applying for the drug. Laws have been passed with regard to the cleaning and cultivation of river reserves. It is as yet too early to judge the effects of these measures, but it is hoped that the next return will show a marked improvement in the number of cases of malarial fever in localities where the campaign is being carried on.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

Annexure A.

Statement showing the Number of Deaths in the Island of Mauritius during the Year 1912.

Districts.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Grand total.
Port Louis : Urban	203	149	170	134	160	120	152	185	206	256	315	232	2,284
,, ,, Extra Urban ...	39	31	45	26	37	38	32	35	47	64	75	83	552
Pamplemousses	150	110	103	114	129	151	140	114	108	127	182	220	1,648
Riviere du Rempart	89	88	111	105	93	91	79	68	73	90	101	152	1,140
Flacq	157	146	157	171	169	166	162	147	125	128	160	232	1,920
Grand Port	150	120	112	130	158	212	165	135	111	117	166	214	1,790
Savanne	116	82	86	85	101	147	109	79	59	74	98	103	1,139
Plaines Wilhems :													
Beau Bassin—Rose Hill ...	70	54	50	19	27	36	26	18	22	40	51	59	472
Quatre Bornes	—	—	7	6	12	14	13	17	13	21	16	24	143
Curepipe	43	23	26	25	26	25	19	32	39	43	64	68	433
Extra Urban	89	51	47	91	118	73	81	72	58	112	159	188	1,139
Moka	94	80	100	61	74	78	79	60	68	77	141	233	1,145
Black River	67	60	45	42	32	57	59	56	46	37	58	65	624
Total	1,267	994	1,059	1,009	1,138	1,208	1,116	1,018	975	1,186	1,586	1,873	14,429

Annexure B.

Rainfall in 1912.

Where Observed.	District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Observatory ...	Pamplemousses.	7·31	31·51	2·92	5·90	6·41	0·90	1·95	1·76	1·56	6·82	1·05	4·83	72·92
Beau Bassin ...	Plaines Wilhems.	6·65	26·11	2·76	2·58	4·02	0·24	0·22	1·53	0·83	4·26	0·16	2·81	52·17
Curepipe ...	Do. do.	7·42	36·07	5·22	4·63	14·95	4·48	7·60	5·69	2·87	8·44	1·69	5 33	104·39
Alma	Moka ...	9·75	50·21	7·93	11·50	17·95	3·77	6·63	7·86	3·70	14·10	2·26	9·04	144·70
Means ...	... ...	7·78	35·97	4·71	6·15	10·83	2·35	4·10	4·21	2·24	8·41	1·29	5·50	93·54

No. 3.

STRAITS SETTLEMENTS.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM 1st JANUARY TO 31st DECEMBER, 1912.

(Received 7 June, 1913.)

1. Name of Colony: Straits Settlements; they include Singapore, Penang, Malacca, Labuan, Province Wellesley, Dindings, Christmas Island, and Cocos Keeling Islands.

2. Total area :

Singapore	217·5	square miles.
Labuan	28·6	,,
Christmas Island ... ... Cocos Keeling	61·8	,,
Penang	108·1	,,
Province Wellesley	280·4	,,
Dindings	182·8	,,
Malacca	720·5	,,
Total	1,599·7	,,

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

3. Population, estimated for 1912 (excluding Christmas Island and Cocos Keeling Island) :—

—	Singapore.	Penang.	Malacca.	Labuan.
A. Total	312,028	282,176	127,797	6,634
B. Europeans	5,875	1,273	313	39
C. Chinese	225,880	113,378	36,526	1,800
D. Other Races	37,267	52,165	9,755	274
E. Malays	43,006	115,360	81,203	4,521
	312,028	282,176	127,797	6,634

Grand Total ... ... 728,635.

4. Births during the year :

Total births registered	20,594

5. Deaths during the year :

(*a*) Total deaths registered	28,422
(*b*) Deaths ascribed to fever :	
Malaria	4,303
Typhoid	105
Not specified	4,194
	8,602
(*c*) Deaths ascribed to blackwater fever	2
(*d*) Deaths ascribed to yellow fever	Nil.

6. Government hospitals :

(*a*) Number of such hospitals, 29, including lunatic asylum.

(*b*) Total during the year :	
Admissions	39,199
Deaths	4,653
(*c*) Malarial fever :	
Admissions	9,172
Deaths	660
(*d*) Blackwater fever :	
Admissions	5
Deaths	2
(*e*) Yellow fever :	
Admissions	Nil.
Deaths	Nil.
(*f*) Filarial diseases :	
Admissions	33
Deaths	Nil.
(*g*) Dengue :	
Admissions	8
Deaths	Nil.

7. Government dispensaries :

(*a*) Singapore	3
Labuan	1
Penang	2
Province Wellesley	4
Dindings	1
Malacca	3
	14

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

(*b*) Total attendances during the year :

Singapore	50,148
Labuan	699
Penang ... ... / Province Wellesley ... ... / Dindings	16,875
Malacca	4,252
	71,974

(*c*) Total attendance for malaria :

Singapore	1,945
Labuan	198
Penang ... ... / Province Wellesley ... ... / Dindings	814
Malacca	577
	3,534

(*d*) Attendances for filarial diseases :
Total 8

(*e*) Attendances for dengue :
Total 70

8. Medical Service :

(*a*) Number of Government Medical Officers ... 26
Number of Assistant Surgeons 27
Number of Municipal Medical Officers:

Singapore	3
Penang	2
	5

(*b*) No. of Special Health Officers :

Singapore :	
Government	3
Municipal	3
Penang :	
Government	1
Municipal	2
	9

Health work elsewhere is carried out by the District Medical Officers. One Health Officer for Malacca has been specially sanctioned for 1913. Two others are under consideration for Singapore and Penang.

(*c*) Number of other registered pratictitioners in private practice 112

9. Schools :

(*a*) The number of Government and State-aided schools:
Total 225

(*b*) The number of scholars registered in these schools. See following statement.

(*c*) Percentage of daily attendances. See following statement.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

—	No. of Schools.	Average Enrolment.	Average Attendance.
SINGAPORE.			
English Schools.			
Government Schools, Boys' and Girls' ...	5	1,980	1,867
Aided " " " ...	11	5,056	4,746
Vernacular Schools.			
Government Schools, Boys' and Girls' ...	17	1,215	1,072
Aided " " " ...	Nil	Nil	Nil
MALACCA.			
English Schools.			
Government Schools, Boys' and Girls' ...	2	468	440
Aided " " " ...	4	809	759
Vernacular Schools.			
Government Schools, Boys' and Girls' ...	78	5,026	4,444
Aided " " " ...	—	—	Nil
PENANG.			
English Schools.			
Government Schools, Boys' and Girls' ...	1	253	225
Aided " " " ...	9	4,364	4,008
Vernacular Schools.			
Government Schools, Boys' and Girls' ...	34	2,325	2,009
Aided " " " ...	—	—	Nil
PROVINCE WELLESLEY.			
English Schools.			
Government Schools, Boys' and Girls' ...	—	—	Nil
Aided " " " ...	4	325	281
Vernacular Schools.			
Government Schools, Boys' and Girls' ...	53	3,548	3,150
Aided " " " ...	3	134	110
DINDINGS.			
Government Vernacular, Boys' school ...	4	170	142
	225	25,673	23,253

10. Estates employing indentured labour.

(The following figures are in respect of indentured and free labour, as very few estates employ indentured labour) :—

(*a*) Singapore (mostly small)	146	Over 25 acres.
Penang	5	
Dindings	9	
Province Wellesley	39	
Malacca	35	
	234	

(*b*) Number of labourers employed:

Singapore	5,869
Penang	214
Province Wellesley ...	12,642
Malacca	19,739
Dindings	1,505
	39,969

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(*c*) Number of hospitals and dispensaries on such estates:

Singapore	3
Penang	Nil.
Province Wellesley ...	19
Dindings	4
Malacca	26
	52

(*d*) Total deaths among such labourers:

Singapore	23
Penang	1
Province Wellesley ...	170
Malacca	454
Dindings	4
	652

(*e*) Deaths ascribed to malaria:

Singapore	6
Penang	Nil.
Province Wellesley ...	7
Malacca	169
Dindings	1
	183

(*f*) Total admissions and attendances at hospitals and dispensaries:

Singapore	5,528	Most of these were daily attendances for quinine.
Penang	0	
Dindings	2,275	
Province Wellesley ...	6,747	
Malacca	24,418	
	38,968	

Answers to (*a*) and (*f*) inclusive are not dependable, for reasons I stated in my 1911 report.*

11. Estimated revenue of the Colony.

The following figures are exclusive of municipalities, for which please see item 13 (*c*) below.

Colonial revenue	$12,027,148
Hospital Board revenue	149,270
Rural Board revenue	505,453
Education Board revenue	202,170
	$12,884,041

12. Estimated expenditure:

Colonial expenditure	$9,655,607
Hospital Board expenditure	301,640
Rural Board expenditure	676,778
Education Board expenditure ...	209,912
	$10,843,937

* See p. 22 of [Cd. 6669] March, 1913.

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

(*b*) Annual medical and sanitary expenditure (inclusive of salaries):
Total $1,710,244

(*c*) Upkeep of Government hospitals and dispensaries:
Total for the year $659,850

(*d*) Total salaries and allowances of Medical Officers and Assistant Surgeons ... $172,893

Medical Officers	$128,182
Assistant Surgeons ...	44,711
	$172,893

(*e*) Total annual sanitary expenditure:

Public Works Department	$275,776
Public Health Officers and Government Veterinary Staff	110,718
Rural Board	44,054
	$430,548

(The above figures for (*a*), (*b*), (*c*), (*d*) and (*e*) are exclusive of municipalities).

13. Towns under municipalities or town councils:

(*a*) Number of such 3

(*b*) Population:

Singapore (estimated)	268,273
Penang (estimated)	102,167
Malacca (estimated)	20,680
	391,120

(*c*) Total revenue (estimated):

Singapore	$3,257,400
Penang	1,185,750
Malacca	112,529
	$4,555,679

(*d*) Total medical and sanitary expenditure:—

Estimated.	Singapore.	Penang.	Malacca.	Total.
1. Health Officer's Department	108,455	38,974	1,844	149,273
2. Cemeteries	5,748	2,000	1,194	8,942
3. Conservancy	324,296	172,580	8,717	505,593
4. Sewerage and Disposal	36,000		5,950	41,950
5. Malaria Prevention	10,000	10,000	—	20,000
6. Drainage	110,000	40,000	1,596	151,596
7. Pathological Department	8,700	—	—	8,700
8. Improvement of insanitary areas	29,250	16,677	—	45,927
9. Isolation Hospital	26,241	700	—	26,941
10. Back Lanes	10,000	11,892	—	21,892
11. Markets	38,638	10,400	—	49,038
12. Slaughter Houses	35,914	10,750	—	46,664
13. Water supply	343,356	152,193	1,699	497,248
	1,086,598	466,166	21,000	1,573,764

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14. Table of deaths by districts :—

District.	Area.	Population.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Singapore ...	217	312,028	1,059	894	891	1,092	1,281	1,467	1.333	1,129	1,022	1,002	981	945	13,096
Penang ...	108	143,236	407	356	372	460	450	503	437	392	348	449	410	370	4,954
Province Wellesley ...	280	130,803	276	241	312	294	351	383	306	289	293	316	300	318	3,679
Dindings ...	183	8,137	28	28	20	17	22	24	23	14	31	32	25	30	294
Malacca ...	720	127,797	613	515	580	531	671	637	442	426	400	425	456	578	6,274
Labuan ...	28	6,634	12	11	3	10	10	6	9	12	19	8	11	14	125
		Total...	2,395	2,045	2,178	2,404	2,785	3,020	2,550	2,262	2,113	2,232	2,183	2,255	28,422

15. Table of deaths in the principal towns :—

Town.	Population.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Singapore	268,273	900	756	783	941	1,125	1,251	1,123	993	885	847	860	806	11,270
Penang	102,167	275	257	279	350	348	366	320	276	251	315	301	267	3,605
Malacca	20,680	115	82	104	101	123	113	84	91	83	71	79	80	1,126
	Total...	1,290	1,095	1,166	1,392	1,596	1,730	1,527	1,360	1,219	1,233	1,240	1,153	16,001

16. Table showing rainfall during the year :—

Where observed.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Singapore ...	4·77	15·03	1·58	8·55	7·32	10·43	4·60	10·61	7·77	11·84	6·49	17·54	106·60
Penang	1·19	3·05	4·09	6·11	14·31	9·37	4·38	14·11	14·86	13·21	10·78	4·61	100·12
Dindings	2·13	6·37	3·23	3·19	9·76	4·64	1·79	4·70	8·22	11·95	9·16	13·79	78·98
Province Wellesley	1·67	3·03	5·46	7·04	9·27	4·77	2·30	11·89	13·55	12·05	10·16	5·90	87·16
Malacca	1·30	3·15	2·55	4·77	8·01	8·50	3·92	6·16	5·55	9·56	5·56	7·90	67·00
Labuan	·72	2·68	3·02	3·57	20·67	16·37	9·54	12·17	14·95	8·13	17·24	8·48	117·51
Total ...	11·78	33·31	19·93	33·23	69·34	54·08	26·53	59·64	64·90	66·74	59·39	58·22	557·40

17.—(*a*) There is no legislation in force against the breeding of mosquitoes in premises. A new Public Health Act is under consideration, and clauses against the breeding of mosquitoes will be introduced. At present we can only deal with such premises as a nuisance. One hundred and twenty-three notices were served and 45 summonses issued.

(*b*) *Singapore.*—Children examined for enlarged spleen numbered 1,694. The examination took place at the different vernacular schools, St. Andrews Boarding School, and the Anglo-Chinese School. Percentage affected was found to be 7·2 per cent.

Penang.—There were altogether 800 children examined for enlarged spleen, all in Province Wellesley; of these 11 per cent. were found affected. The examination was done in the districts of Butterworth, Bukit Mertajam, and Sungei Bakap.

Dindings.—Eight examined at the police quarters, 90 per cent. affected.

Malacca.—Children examined for enlarged spleen, 270; 70·37 per cent. affected.

(*c*) No. of persons examined for filarial diseases :—(1) At the General Hospital in Malacca 3 persons were examined, all were found affected. Singapore none. Penang 6; percentage affected not recorded.

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(*d*) Any large work for surface drainage, &c., and cost:—
By the Public Works Department, Singapore :

	$
Raising low-lying ground at rear of Arab Street Vernacular School	1,300
Draining gully north side of Government House	3,172
Main drain at Criminal Prison extended and improved	1,000
Masoning drains constructed at $7\frac{1}{4}$ mile Bukit Timah Road and $6\frac{3}{4}$ mile Changi Road to discharge sullage water from villages	1,126

By the Public Works Department, Malacca :

Kubu Lane filled in and cement drain made at a cost of	1,000

By the Public Works Department, Penang :

Concrete outlet drains connecting 3 culverts with the sea	4,390
Extension of brick drains B. Pulau	2,998

By the Public Works Department, Labuan :

About $2,000 were spent upon anti-malarial works. These include additional concrete drains in the town of Victoria; the filling up of a large area of swampy land at the eastern extremity of the town; the cutting and burning of large areas of jungle in the suburbs.

(*e*) Number of men employed for petty anti-mosquito works, with cost:—
Singapore Municipality, 48 men, cost $5,424.
There were none employed especially for this purpose in other settlements.

(*f*) Amount of Government quinine sold or given gratis. Agencies employed :—
Singapore Health Department, 77,500 grains, given by Health Department. Singapore anti-malarial officers, 84,000 grains. Labuan, 42,432 grains by Medical Officer. Malacca, 15 lbs. 11 ozs. 2 drams., distributed through the Rural Board and Health Officer; also the Vernacular School teachers, who distributed at the police station, and by Penghulus and Roman Catholic Missionaries. Penang.—No special record kept, but a quantity was distributed through schools and police. Public Works Department coolies were supplied as required.

(*g*) Is quinine distributed regularly in the schools? Yes. In malarious districts.

(*h*) Measures taken against these diseases on estates :—

The Estate Labourers' Protection of Health Ordinance recently passed is being gradually enforced. A copy of this Ordinance, passed in 1911, with rules is hereto attached.* The question of building group hospitals for the treatment of estate coolies residing within a 7-mile radius from the Hospital is now under consideration of Government for Malacca. In all settlements much work is done on estates to fill up and drain swamps. No special record is kept.

(*i*) Any step taken regarding the housing of the poor :—

Singapore :

(1) Demolition of insanitary huts.
(2) Kampong Kapur Improvement Scheme.
(3) Revised Building By-laws.

Malacca :

There are lodging houses where poor people get bed and lodgings. These are run by different Chinese clans. Vagrants are sent to house of detention.

Penang :

Inside municipal area much is done by Sanitary Inspectors to see that houses, drains, latrines, and back premises are kept clean.

(*j*) There was a considerable decrease in malaria in Labuan.

In Malacca there has been a decrease in malarial fever incidence throughout the country.

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* Not reprinted.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

The following table shows the admissions for, and deaths from, malaria in all the hospitals of the Colony for the past 10 years.

——	Remaining.	Admitted.	Total treated.	Deaths.
1903	89	2,163	2,252	177
1904	38	2,547	2,585	188
1905	59	2,752	2,811	286
1906	46	2,791	2,837	251
1907	98	4,261	4,359	295
1908	108	4,617	4,725	509
1909	137	4,946	5,083	431
1910	103	7,330	7,433	690
1911	123	11,815	11,938	1,014
1912	302	9,172	9,474	660

Lectures on malaria and mosquitoes were given to school teachers and in the Malay language at the public and vernacular schools in Malacca.

Arrangements are being made to give courses of lectures in Singapore and Penang also.

Early in the year Dr. Finlayson, Government Pathologist, was seconded for service on the Anti-malarial Committee, and throughout the year considerable work has been done with the view of eradicating within Singapore municipal limits all breeding places of malaria-carrying mosquitoes. I attach his report for 1912. (Enclosure 1.)

W. Gilmore Ellis.
Principal Civil Medical Officer,
Straits Settlements.

Singapore,
1st May, 1913.

Enclosure 1 in No. 3.

Sir, Sepoy Lines, Singapore, February, 1913.

In submitting my report for 1912 I desire to institute a comparison between the present condition of the varied breeding grounds in the Telok Blangah area with the state which existed when the district was examined by Dr. Watson, and to recapitulate briefly certain points which have been brought up in prior monthly reports. Further, I wish to summarise the measures undertaken by the municipal authorities to abolish breeding areas within the town limits, together with the cost of construction and maintenance. In subsequent sections I shall discuss the returns available from Tan Tock Seng Hospital, the General Hospital, and the Assistant Registrar, which, though inaccurate, tend to show that Singapore is a "reception house" for the sick from Johore and the Peninsula generally, from the adjoining islands, and from the country districts of the Island itself. I shall point out what may be considered endemic foci within the municipal boundaries, and what methods may be adopted for their eradication. The splenic index of school children hitherto examined will be briefly considered while, finally, I shall touch upon the examination of blood films, quinine distribution, and one or two experiments with mosquitoes. The question is often brought up what percentage of the malaria present in Singapore is truly endemic. With the incomplete or erroneous, sometimes conflicting, statements with which one has to deal even the mind and energies of such an eminent biometrician as Karl Pearson would be overtaxed to elaborate a formula which would give the ratio between endemic and imported malarial cases.

Numerous factors—what number suffering from active malaria enter the town limits, what percentage of malaria "carriers" immigrate from China, the Peninsula, &c., their duration of stay within the boundaries, their proximity to breeding places of anopheline transmitters, the number of mosquitoes hatching out from such situations, with the percentage of anophelines caught, and proved on examination to be infected with zygotes, what probable number is a recent infection, and what are merely relapses, such factors, indeed, as would be a herculean task to

extract from the present Asiatic population—would have to be determined before one is capable of giving an approximate figure. One may with great diffidence hazard the opinion that the figure of epidemic malaria lies somewhere between 20-40 per cent., probably nearer the lower than the higher.

Dr. Middleton, Municipal Health Officer, in his report on malaria, 1911, remarked "that the one consistent condition through the four years is the rise and fall among Chinese with the increase and decrease in Chinese immigration," but, from his other premises, conclusion No. 2, "that while a considerable proportion of cases may be imported, the majority are indigenous," cannot be upheld on considering what a great number of the floating population contract malaria beyond the municipal boundaries, and the low splenic index of residential Chinese children.

Some further factors, I imagine, must be taken into account when a high death-rate amongst children in Singapore coincides with a high malaria index in the adult death-rate.

Kampong Bahru Area.

Breeding places Nos. 1, 2, 3, between Cantonment Road and Spottiswoode.—The great portion of this area has been filled in and raised, with the exception of a pond adjacent to the railway crossing in Cantonment Road and a triangular patch behind Spottiswoode on which the new dock contractors are at present engaged. Into the latter pours the storm water and sewage from Spottiswoode Park, while the ditch cut along the western side is of insufficient depth to carry it off rapidly. No anopheline larvæ were detected in this filthy pond, but the larvæ of other culicidæ are breeding out in great number. Why it appears so difficult to establish an efficient drainage system while such constructive works are in progress it is impossible to conjecture. A drain has recently been cut by the contractors to carry off water from a large pond in the neighbourhood of Cantonment Road into the eastern drain so that the part is now almost dry, which feat of engineering I was informed some months ago was not feasible, owing to the difference in levels between the bottom of the pond and the invert of the drain.

It appears to me that a properly-graded drain could take with equal facility the flood water from Spottiswoode into the same culvert, though it would require constant supervision to prevent silting up.

Naturally, as subsidence goes on irregularly, numerous semi-permanent pools are distributed over the raised portion where *N. rossi* and *M. sinensis* larvæ are constantly found, but steps are being taken to have these dealt with as occasion arises.

Mangrove, west of Spottiswoode Park.

Nos. 4 and 5.—The work of filling in No. 4 from Raeburn House side is being rapidly pushed forward, while No. 5 has been completed. As on the finished portion of Nos. 2 and 3 there are low-lying parts where surface water accumulates and remains for such lengthy periods as enables them to become breeding pools.

These should be either regularly treated with oil or efficiently drained. It is quite true that only such feeble carriers as *N. rossi* and *M. sinensis* breed out on this section, but a small gang of coolies could readily oil such or make temporary drains which, however, would require strict attention to prevent silting and overgrowth with weed. I have already drawn your attention to the point that *N. ludlowi* has practically disappeared, owing to the altered conditions.

No. 6, Neil Road.—A building is now erected on this part.

No. 7, Golf Course Stream.—This remains in its former state, but estimates have now been called for by the Public Works Department to carry out certain proposed work.

No. 8, Keith's Swamp.—The condition of this swamp has frequently been commented upon in the progress reports. So long as vegetable gardeners are permitted to remain, this section will prove a breeding ground for *N. rossi* and flies, as nightsoil is constantly in use for manuring the ground. No *N. karwari* larvæ has been demonstrated, while the drainage system recommended by Dr. Watson, has dried up a considerable portion of the swamp land adjacent to Silat Road.

No. 9.—This has been filled in, while a grip was cut along the west side to bring the water from No. 8 into the roadside drain.

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Nos. 11, 12, 13.—These sections could have been readily drained save a small portion at the upper end of No. 11, which requires to be raised; a notice was served on the owner of this some six months ago, but it has not yet been complied with. Now that the iron piles have been removed, and the outlet thus lowered, it should be possible to construct a more efficient drain along Kampong Bahru Road. At present this is merely a silted-up, shallow-running ditch overgrown with weed and other vegetation in which larvæ of *N. rossi* and *M. sinensis* are breeding out in enormous numbers in spite of the fact that three types of larvæ-eating fish are present in abundance :—

Haplochilus panchax (Ikan mata lalat).
Hemirhamphus fluviatilia (Ikan julong julong).
Ophiocephalus striatus (Ikan aruan).

When the scheme submitted by the T. P. D. authorities has been completed, the flood water should be carried off rapidly, and there is no reason but to suppose that only small, isolated portions, where springs issue from the hillside, will remain to be dealt with, by piping or other measures, to bring about the abolition of all anopheline breeding places.

Nos. 14, 15, 16, Tiong Bahru.—The drainage system adopted has proved most efficient. All now necessary are upkeep and the prevention of the squatters blocking the drains to secure flooding of the land for agricultural purposes.

Radin Mas.

No. 17.—The work of filling in and raising is being carried on, and will be completed shortly.

Nos. 18, 19, 20.—Since these sections were efficiently drained no anopheline larvæ have been found on repeated examination.

No. 51.—This low-lying part has been drained, and is now quite dry.

Nos. 21-23, and No. 24.—Under the direction of Mr. Lermit, acting for the owner, all the blukar, &c., was cut down and burned on the slopes of Mount Faber, and a system of earth drains constructed in these ravines.

It has been pointed out that *N. karwari* larvæ are still to be found in number in the upper sections, more especially in the check foothill drains, where springs have been tapped. It is now under consideration what sections of these ravines will be pipe drained with the estimated cost, so that measures be taken to have these breeding grounds eradicated.

Two small ravines on the Tiong Bahru side of the valley were also drained in an efficient manner under the superintendence of the engineer in charge.

Breeze Hill.

Nos. 25, 26, 27, 53.—The water-level on these sections was also affected by the raising of the western drain outlet. It will be interesting to observe what amount of lowering of the water-level will take place, and what portions will remain permanently dry, when the outlet has been lowered and the box drain kept free from silt.

All flood water with sewage, &c., from Breeze Hill and Radin Mas areas flows under the culvert in Nelson Road, so that on any blockage occurring naturally this low-lying, swampy section is converted into an extensive filthy pond.

No. 28.—This has been filled in.

No. 29.—A series of foothill and intersecting drains has been cut in this section.

A careful watch, as suggested by Dr. Watson, has been kept on the foothills since the investigation commenced, but no anopheline larvæ have been found in any spring issuing from Breeze Hill. This is probably due to the fact that the Chinese inhabitants have dug numerous shallow wells, and as both the wells and the overflow water are foully contaminated, it is most unlikely that a nyssorhynchus finds a breeding place, the spring water being tapped by these sunken pits. The upper part of the valley is a likely breeding ground, but hitherto all search has been unsuccessful.

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Keppel Harbour Area.

Nos. 30-37.—The condition is unchanged.

No work has been carried out at these points since, on repeated examination, no larvæ have been found save some of *N. rossi* in a roadside drain.

Mosquito Ravine.

Nos. 38-39.—The drains have been kept fairly clear. No anopheline larvæ have been found at any time during the year.

Chandu Factory Ravine.

Nos. 40-41.—Remarks similar to those make on No. 36 apply to this section. A system of foothill and central earth drains was cut in the lower part, while the top of the ravine was dealt with by the Public Works Department, so that the factory might obtain a richer water supply.

Seah Im Road.

Nos. 42-43.—Messrs. Hammer and Company piped a short part of this ravine, which did away with a *N. karwari* breeding spot. During the wet weather, however, the scouring was so great that the measures adopted proved ineffective, so that a relapse into the old condition is certain to occur. The upper part of the ravine lies within the boundary of Mr. Wong Ah Fook's property, so at present a plan is being prepared by Mr. McGee which will be submitted to the owners so that conjoint action may be taken to abolish the breeding ground. The plan and estimates are still under consideration.

Keppel House Ravine.

Nos. 44-46.—The breeding grounds at the bottom of the valley have been levelled and drained, while the overflow from the smaller dam is carried away by a foothill drain. No work, so far, has been undertaken in regard to the stream, where occasionally a few *N. karwari* larvæ are caught.

Morse Road Ravine.

Nos. 47-49.—On several occasions *N. karwari* larvæ have been found in No. 49, none in the lower reaches of the stream, which was diverted to join the stream from No. 46, instead of allowing it to flow over a strip of land adjacent to Telok Blangah Road, on which *N. rossi* and *M. sinensis* bred out abundantly.

42A.—Waste land lying between Seah Im Road and the tramway terminus.

This breeding ground for *N. maculatus* was drained by the T. P. A. authorities, but, as I noted previously, larvæ are still found in the check drains of a certain part, so, meantime, a plan is under consideration to have it thoroughly dealt with. I have no doubt but that this section accounted for a considerable number of the epidemic malarial cases in the adjacent coolie lines. Further, the ditches and drains beside the new graving dock, in which similar larvæ were found, have been regularly treated with oil and Jeyes' Fluid for some months past.

Cost of cutting and maintaining drains, &c., within the Telok Blangah Area.

Coolies wages :—

April	$462·50
May	648·30
June	610·08
July	756·91
August	788·67
September	843·87
October	978·30
November	423·40
December	390·80
Implements	17·45
	$5,920·28

The gangs worked under the direction of an engineer-in-charge, who was paid a salary of $150 per mensem.

Appendix I.

Reports on Anti-Malarial Measures in the Crown Colonies and Protectorates, &c.

Municipal Measures.

In my report for October, 1912, I stated what works had been carried out by the municipal authorities and what were still under construction. Many patches of low-lying, swampy land, breeding places of *N. rossi* or *M. sinensis*, have been efficiently drained. In certain sections the drains are still maintained, kept free of silt and vegetation, by the municipality, in other parts by the owners.

Appended is the report* by the Chief Sanitary Inspector, who has been in charge of the gangs, to the Municipal Health Officer.

Three gangs, consisting of one mandor and 15 coolies, have been employed from the 1st April till 31st December, felling jungle, cutting and cleaning drains, filling in pools and ponds, and clearing streams at the following places :—

(1) Kramat Road.—Clearing jungle, cutting and clearing drains.
(2) Payah Goyang.—Clearing jungle, filling ponds, cutting and cleaning drains.
(3) Stream, Grange Road, and ground on the right and left of stream as far as One Tree Hill.—Clearing jungle, filling ponds, and clearing stream and drains (a small portion of the stream near One Tree Hill has been piped).
(4) Anderson Road, at its junction with Stevens Road (both corners).—Felling jungle, cutting drains, and filling ponds.
(5) Anderson Road to Orchard Road.—Clearing jungle and cutting drain (the upper portion of drain is now being piped).
(6) Stream, from entrance to Waverley, Orchard Road, to Tanglin Hill.—Clearing stream.
(7) Swamp of Tanglin Road.—Cutting drains and clearing jungle.
(8) Cuppage Road.—Cutting drains and filling pools.
(9) Railway cutting near the Castle Cavanagh Road.—Clearing drains.
(10) Leoni Hill Road at its junction with River Valley Road (both corners).—Cutting drains and clearing jungle.
(11) Nathan Road.—Cutting drains and clearing jungle.
(12) Roadside drain in River Valley Road (from Nathan Road to river).—Deepening drain.
(13) Moulmein Road, next to entrance to T. T. S. Hospital.—Cutting drain.
(14) Grass Swamp, Jervois Road.—Clearing jungle and cutting drains.
(15) Swamp in Dalvey Road, opposite Nassim Road, and stream leading to Bukit Timah Road.

724 hand-cart loads of tins were collected and removed.

The average daily number of mandors and coolies working during the year was as follows :—

Mandors	3
Coolies	41·89
Cost of labour :—	
Daily mandors	60 cents.
Daily coolies	40 „
Expenditure during the year :—	
Mandors and coolies	$5,189·84
Tools, &c.	234·32
	$5,424·16

Under the superintendence of Mr. McGee underground pipes have been laid down in the upper part of the One Tree Hill stream, while the greater part of the stream at Grange Grove Road has been similarly treated. Of the former no larvæ have been found in the lower reaches, though looked for on several occasions, while the construction of the latter has just been completed.

Some little time must elapse before one can show that such works have proved

* Not transmitted.

their efficiency, but hitherto the scouring by storm water has not to any appreciable degree affected the surface nor the imbedding material.

Further, a gang of coolies, under the charge of Mr. McGee, has cut a series of drains from the $3\frac{1}{2}$ milestone, Bukit Timah Road, to Stevens Road, the water discharging under a culvert recently erected in Bukit Timah Road, while the valley running from Stevens Road to Fernhill has been similarly drained. At the upper part of this valley are several *N. maculatus* breeding grounds, which it may be necessary to pipe-drain or abolish by other measures.

(1) Pipe-draining One Tree Hill Stream, $250.
(2) Pipe-draining Orange Grove Road Stream, $450.
(3) Drain from Bukit Timah Road to Stevens Road } $728·15.
Culvert, } 250
(4) Drain from Stevens Road to Fern Hill, $210·60.

Situated between Arab Street, Rochor Canal Road, and a Malay burial ground was a low-lying piece of ground which has been filled in, partly by the Public Works Department and partly by the owners, thereby eradicating a *M. sinensis* breeding place.

The Government plantation, Stevens Road, will permanently prove an obnoxious breeding ground unless a proper drainage system is laid down, while, in addition, it may be necessary to raise the level of the land at certain points.

Finally I may touch on the Kampong Kapor Improvement area, where an extensive breeding ground of *M. sinensis* and *N. rossi*—formerly also of *N. ludlowi* when the mangrove swamp was still a tidal creek—is being gradually abolished. Where it is impossible to drain pools and ponds, crude oil is at intervals thrown over them until filling in has been completed, so that in a short time a marked change in the local conditions should result. It may be admissible at this point to make some remarks on the nyssorhynchus breeding grounds—such as have so far been found within the municipal limits.

It has been shown that *N. karwari* breeds out in fair number in the various gullies of Mount Faber, while from time to time I have reported that *N. maculatus* larvæ have been noted in Telok Blangah Road, adjacent to the tramway terminus, McKenzie Road, One Tree Hill Stream, Orange Grove Road Stream, and Cairn Hill railway cutting, while I have recently observed them at the base of Mount Wallich, Pearls Hill railway cutting, Fernhill, and Fort Canning Road.

Frequent search has been made for the same larvæ in the cuttings at Bukit Passoh, Duxton Hill, and Raeburn House, where the conditions are exactly similar to those at Cainhill, but without success. Numerous larvæ of *N. rossi* and *M. sinensis* have been caught, but I imagine that at some time or other the larvæ of *N. maculatus* will also be observed. Naturally there is a reason why the nyssorhynchus should select such special points. It is essentially a clean stream or spring breeder where there is an abundant food supply, provided by the presence of algæ and other vegetable growth.

Why the railway cuttings and such situations as McKenzie Road, Mount Wallich, &c., have been selected is due to the fact that in excavating the soil certain springs have been tapped which afford a continuous supply of clear water even in dry weather.

The problem remains, how can one abolish such a flow? By piping, broken stone, or coral drains, covered by a layer of impervious soil to allow storm water to run over and inhibit silting? Great difficulty seems to arise in the construction of such a drain as will take away a slight flow, and not silt up rapidly. Granted, however, that such a drain does silt up comparatively quickly, I maintain that it is better to construct such and reduce the number of malarial carriers in all these situations, even though the drain has to be dug up, cleaned, and reconstructed at intervals of some months, or mayhap years, when it becomes inefficient. Such a work, therefore, as the removal of soil from the side of Fort Canning Hill and interfering with the subsoil flow so that a spring is laid bare in which *N. maculatus*

breeds out, to fill up an adjacent piece of low-lying ground where *N. rossi* larvæ are found, is not in its essence anti-malarial but pro-malarial.

I have dealt with this point, as Dr. Watson in his report stated that he could not hold [that] such a feeble carrier as *M. senensis* could account for the high malarial incidence, and suggested that such carriers as *N. karwari* or *N. maculatus sive willmori* were probably responsible for the greater number of endemic cases, seeing that the spleen rate increased as one approached the foothills of Mount Faber. In my opinion comparatively few of the residential population of Singapore contract malaria within the town limits, owing to the fact that there are only isolated breeding places where the larvæ of definite carriers are observed, but further investigations may show that such are foci for the dissemination of the disease, as there is a wealth of material pouring in from Johore, &c., on which these mosquitoes may feed and transmit infection to the residents of a particular neighbourhood. From the examination of the returns which I now beg to submit I think it is clearly demonstrated that a very large percentage of those who attend the hospitals, &c., contract the infection beyond the town limits, while it is impossible to find out how many of those who state they have resided in the town for a more or less lengthy period have suffered from the primary attack before their arrival in the Colony, so it may be that what is considered an endemic case is merely a relapse.

Return from Tan Tock Seng Hospital—July 1st to December 31st, 1912.

Number of admissions	1,750
Chinese	1,364
Tamil	301
Malabari	41
Arab	8
Sikh	3
Malay	7
Javanese	12
Cingalese	8
Japanese	3
Eurasian	3
	1,750

Of these 131, or approximately 7·5 per cent., died—

Within 24 hours of admission, 41, or 31·3 per cent., of total deaths.
Within 48 hours of admission, 67, or 51·2 per cent., of total deaths.
Within 72 hours of admission, 84, or 64·1 per cent., of total deaths.

Of these 14 came from Johore, 12 from Bukit Timah District, and 8 from Teluk Blangah area. Of the number admitted, 712, or 40·7 per cent., stated that they had arrived in the Colony at periods varying from one day to six months; 498, or 70 per cent. of the immigrants, within a month, which is only slightly over the incubation period of malaria.

—	Johore.	India.	China.	Malacca.	Penang.	P. Ubin.	P. Tekong.	P. Balang.	P. Malintang.	Klang.	K. Lumpur.	Seramban.	Perak.	Kuantan.	Kelantan.	Tringganu.	Patani.	S. Ujong.	B. N. Borneo.	B. Mati.	Carimon Island.	P. Samboe.	P. Bukum.	Deli.	Pontianak.	Java.	Ceylon.	Rhio.	Siam.	Zanzibar.	Burmah.
Within 3 days.	94	—	—	—	—	—	—	—	—	—	—	—	—	—	4	—	—	—	1	3	—	—	—	—	—	—	—	—	—	—	—
1 week	65	7	4	7	2	28	6	12	4	4	2	5	1	1	—	1	—	1	4	2	13	6	1	2	—	—	—	7	—	—	—
2 weeks	59	9	8	5	2	3	—	3	—	1	—	4	1	2	2	1	1	—	—	—	3	2	1	—	1	—	—	1	1	—	—
1 month	42	13	17	1	2	1	4	2	1	2	1	1	—	2	—	—	—	—	1	—	—	3	—	—	—	1	1	4	—	1	1
2–3 months.	12	36	47	1	2	2	—	2	2	—	—	—	—	1	4	—	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—
4–6 months.	3	46	53	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	275	111	129	14	8	34	10	19	7	7	3	10	2	6	10	2	1	1	6	5	19	11	2	2	1	1	1	12	1	1	1

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

In addition it is of interest to note that there were admitted from

(1) Telok Blangah area, 267, 53 within two months of arrival.
(2) Bukit Timah District, 148, mostly from rubber estates.
(3) Upper Serangoon, 40, three from Punggol.
(4) Gaylang, 18.
(5) Thomson Road, 30, beyond 4th milestone.
(6) Tanjong Katong, 7, about 5th milestone.
(7) Bedoh, 1.
(8) Siglap, 3.
(9) Pasir Rys, 2.
(10) Tampenis Road, 10, from rubber estates.
(11) Pasir Pandjang, 6.

Only a brief comment is called for on these returns, as undoubtedly proof is afforded to demonstrate the great influx of malarial patients from such highly endemic centres as the rubber estates in Johore, in the island of Singapore, and adjacent islands.

General Hospital Returns—January 1st to December 31st, 1912.

No note was made regarding the duration of residence in Singapore.
Number of admissions, 673—male, 654; female, 19.

Chinese	463
Tamil	79
Bengali Hindu	34
Bengali Islam	7
Malabari Hindu	3
Malabari Islam	14
Sikh	25
Punjaubi	2
Indian Islam	6
Cingalese	6
Malay	5
Javanese	5
Annamese	1
Japanese	2
Eurasian	1

Of these 61, or 9 per cent., died—

Within 24 hours of admission, 21, or 34·4 per cent., of total deaths.
Within 48 hours of admission, 37, or 60·6 per cent., of total deaths.
Within 5 days of admission, 50, or 82 per cent., of total deaths.

The patients were admitted from—

(1) Telok Blangah area, 223.

Including (*a*) Tandjong Pagar Dock	125
(*b*) Duxton Road	26
(*c*) Tandjong Pagar Road	9
(*d*) Keppel Harbour	26
(*e*) General Hospital staff	13
(*f*) Warders, Criminal Prison	10
(*g*) Lunatic Asylum	4

(2) Rubber estates, 46, locality not given.
(3) Federated Malay States Railway staff, 37.
(4) Pulo Brani, 5.
(5) Ships in harbour, 8.
(6) People's Park Districts, 23—Park Road, Market Street, Wayang Street, &c.
(7) Rochor District, 60—Queen Street, Victoria Street, &c.
(8) "Sinkeh Bangsals," 49.

Examining the returns from General Hospital, which I may remark are not absolutely reliable, one is struck by the high figure in a few localities, &c.

Duxton Road, 26. Here there is a markedly shifting population of the ricksha and dock coolie class, but the road runs parallel to, and in the immediate vicinity of, the railway cutting in Duxton Hill.

People's Park District, 23. As this lies within half a mile of the hospital one would expect that the inhabitants when sick would apply for treatment more readily than if they lived some considerable distance away. Again, at this point are found breeding grounds of *N. maculatus* within a short distance of the dwelling houses, so one may disregard the presence of *N. rossi*, which breeds out in the ditches of the Park itself.

Rochor District, 60. The patients for the most part are ricksha coolies. Where infection has been contracted is problematical; it may be that they were exposed to infection in other parts of the town when plying for hire, or that the primary attack developed when they followed some other calling in a different part of the Peninsula. No likely breeding ground in the quarter of the town in which they reside has been discovered, while the splenic index of the children who live in the same district is practically nil.

"Sinkeh," 49. These are recent immigrants with no obtainable history

Warders, Criminal Prison, 10. Behind their quarters the hillside has been excavated with the natural result that the subsoil drainage has been interfered with. Search, so far, has revealed the presence of only *N. rossi* larvæ, but one expects to find *N. maculatus* larvæ at some subsequent date.

Rubber Estates, 46; and Federated Malay States Railway staff, 37.

Comment on this point is unnecessary.

Keppel Harbour, 26. Of these 13 were admitted from the Chandu Factory with the history that 10 lived on the premises. As previously recorded by Dr. Watson, the ravine behind was a suspected breeding ground, but up to the present the larvæ have not been demonstrated. Since February 12th, 1912, Mr. Paulusz, Assistant Registrar, has attempted to elicit some information from friends or relatives regarding the period of time the deceased individuals had resided in the settlement immediately prior to death. In many instances naturally the information acquired is most inaccurate, as the Oriental usually gives most evasive answers to all queries, while in a certain percentage an autopsy would probably have shown that the person died from some other disease. The enquiry, however, was conducted so that a general idea might be obtained, and I think that one or two results are rather striking, notably the great number of coolies who drift in from Johore and die within a short time after arrival. The information on this point cannot be altogether disregarded, as it is scarcely conceivable that the majority of the replies was false.

The number from Pulo Ubin is also remarkably high.

Total number of individuals inspected on the south side who were certified as having died of malaria, 445.

(1) From Johore	28	within	2 weeks.
	56	,,	two-four weeks.
	22	,,	one-three months.
(2) Pasir Panjang	3	,,	one month.
(3) Upper Serangoon	4	,,	one month.
(4) Changi	6	,,	two weeks.
	3	,,	two-four weeks.
(5) Bukit Timah	2	,,	two-four weeks.
(6) Pulo Ubin	6	,,	two weeks.
	10	,,	two-four weeks.
	1	,,	two months.
(7) Pulo Bukum	3	,,	two weeks.
	4	,,	two-four weeks.

(8) Malacca	3	within two weeks.
	5	„ two-four weeks.
(9) Penang	3	„ two-four weeks.
	3	„ one-two months.
(10) Perak	1	„ three weeks.
(11) Kedah	1	„ three weeks.
(12) Padang	3	„ three-six weeks.
(13) Kuala Lumpor	3	„ two-four weeks.
	1	„ three months.
(14) Palembang	1	„ six weeks.
(15) Rhio	6	„ two-four weeks.
	2	„ two months.
(16) Deli	2	„ two-four weeks.
	1	„ two months.
(17) Pontianak	2	„ one month.
(18) China	5	„ two months.
(19) Unknown rubber estates ...	3	„ two weeks.
	6	„ two-four weeks.
	4	„ two months.
	203	

Were such a return reliable it would show that 45·6 per cent. of the cases certified by the Assistant Registrar probably contracted the infection outside the municipal boundaries. Assuredly, however, one may safely deduce that a considerable percentage was imported.

The history obtainable of the remainder, 242, was to the effect that they had resided in the different districts for some considerable time.

Districts :—

(1) Section bounded by Boat Quay, New Bridge Road, Sago Lane line, and Cecil Street	60
(2) Bukit Pasoh neighbourhood	8
(3) Silat Road to Keppel Harbour, including Tiong Bahru	43
(4) River Valley Road, Orchard Road, and Tanglin	30
(5) Tanjong Pagar Road, Duxton Hill, with adjoining streets ...	53
(6) Havelock Road to Bukit Ho Swee with adjoining streets	48
	242

Granted that the number of imported cases is exaggerated, and that a certain percentage is truly endemic, it may, on the other hand, be upheld that, were a reliable history obtainable, it might be demonstrated that in a certain percentage of so-called endemic cases death was due to an infection contracted elsewhere. It scarcely seems credible that such a number—60—living in a densely-populated Chinese quarter, China Street, Sago Street, Cross Street, &c., should contract an infection when Straits-born Chinese children in Cecil Street, Telok Ayer Street, &c., sleep without mosquito nets, and seldom are infected. With the conditions obtaining closer to the foothills—a large reservoir of imported individuals, in whom malarial gametes are circulating in the peripheral blood, in the vicinity of breeding grounds of malarial carriers—excellent opportunities are afforded the mosquito of transmitting infection. Take Lim Eng Bee Lane, for example: two were stated to be endemic, while no less than nine were given as imported—7 from Johore, 1 from Changi, and 1 from Pulo Ubin.

Duxton Road.—Nine were given as endemic, while two were imported from Johore. This locality I have already dealt with in a previous paragraph, showing that it may be considered an endemic centre.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

Examination of school children.

In the latter part of 1911 Dr. Middleton, Municipal Health Officer, and myself examined the children attending the vernacular schools, but as no record has been published it may be inserted in this report.

—	Total examined.	Enlarged spleen.
Rochor Boys' School	143	27
Kampong Glam Boys' School	274	34
Telok Blangah „ „	39	18
Kampong Jagoh „ „	44	13
Sepoy Lines „ „	46	7
Sumbawa Road Girls' School	52	—
Kampong Roko Boys' School	51	2
Kallang Boys' School	69	3
Lower Tanglin Boys' School	67	4
Upper „ „ „	45	5
	830	113
	or 13·6 per cent.	

It was requested that a watch be kept on the spleen incidence of the children attending the schools in Telok Blangah area.

—	Total examined.	Enlarged spleen.	Percentage enlarged.
August, 1911—Telok Blangah School	39	18	46·1
April, 1912— „ „ „	52	26	50·
January, 1913— „ „ „	58	12	20·7
August, 1911—Kampong Jagoh School ...	44	13	29·5
April, 1912— „ „ „ ...	45	8	17·7
January, 1913— „ „ „ ...	51	8	15·7
Anglo Chinese School, 1911	484	14	3 % approximately

Of these 5 came from the Telok Blangah area.

St. Andrews Boys' School, 1912 :—

Total examined, 357; spleen enlarged, 6; per cent. enlarged, 1·7 per cent.

Quite a large percentage of the children attending these two latter schools are Straits-born Chinese, and reside in different districts of the town, both north and south of the river.

In a prior report I have already stated that the splenic index of the children resident in the Telok Blangah District is practically the same as when examined by Dr. Watson.

Blood film examination.

Returns have been furnished in the monthly reports of the examination of films taken from patients attending the outdoor dispensary :—

Total number of films examined, 907; positive 565, negative 342.

Of the former number 182, or 32·4 per cent., attended, stating they live within the Telok Blangah area, while 78, or almost 14 per cent., had recently arrived from Johore. I have called attention to the fact that the number of attendances from the Telok Blangah District was greatly reduced after house-to-house visitation by the quinine distributer was introduced.

Quinine distribution.

From the date of his engagement, October, 1912, until the end of the year, Mr. Cheok Peng distributed within the Telok Blangah area some 29,000 grains of

quinine hydrochloride provided by the municipality, with a further 55,000 grains purchased at a cost of $97·50.

Enquiries conducted beyond municipal limits :—

(1) With Dr. Ellis, Principal Civil Medical Officer, and Dr. Wilson, Principal Medical Officer, Johore, a visit was paid to a number of rubber estates under Japanese management along the Johore River. Sufficient evidence was afforded to prove that this was a highly endemic centre.

(2) A few days were spent at Jasin, Malacca, and a report on the conditions observed was forwarded to the Principal Civil Medical Officer, Straits Settlements.

(3) The breeding grounds on Blakan Mati Island were investigated with Captain Williamson, R.A.M.C., and the presence of *N. maculatus* larvæ was demonstrated in typical situations.

(4) Along with the Municipal Health Officer and Mining Engineer Pulo Ubin was visited, when it was shown that an extensive breeding place of *N. maculatus* larvæ lay in the immediate vicinity of the coolie lines.

Experiments with Anophelines.

As there is still considerable doubt whether *N. rossi* is a malarial carrier, a series of experiments were made. Imagines, bred out from larvæ, were allowed to feed on patients whose peripheral blood exhibited the presence of numerous crescents. Great difficulty was experienced in keeping the insects alive in captivity, so that only ten were examined on the sixth day and later. No zygote was observed in the stomach wall. Similar disappointment was experienced with *N. maculatus* and *N. ludlowi*. A few *M. sinensis* survived until the tenth day, but in these also no malarial infection was demonstrated. A number of *N. rossi* imagines captured in the Telok Blangah area have been dissected with a negative result.

R. J. Farrer, Esq.,
Honorary Secretary, Anti-Malaria Committee.

No. 4.

NYASALAND.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1st JANUARY TO THE 31st DECEMBER, 1912.

(Received in Colonial Office, 26 May, 1913.)

1. Name of Colony : Nyasaland Protectorate.
2. Total area : 39,801 square miles.
3. Estimated population :—
   (a) Total, 1,000,659.
   (b) Europeans, 773.
   (c) Asiatics, 463.
   (d) Africans, 999,423.
4. Births during the year :—
   Total births (no record).
   (a) Europeans, 24.
   (b) Asiatics, 1.
   (c) Africans (no record).

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5. Deaths during the year :—
(a) Europeans, 7.
(b) Asiatics, 4.
(c) Africans (no record).
Deaths ascribed to fever, nil.
Deaths ascribed to blackwater fever, 3.
Deaths ascribed to yellow fever, nil.

6. Government Hospitals :—
(a) Number of such hospitals, 8.
(b) Totals during year :—

Admissions	1,318
Deaths	42

(c) Malarial fever :—

Admissions	137
Deaths	Nil.

(d) Blackwater fever :—

Admissions	12
Deaths	3

(e) Yellow fever :—

Admissions	Nil.
Deaths	Nil.

(f) Filarial diseases :—

Admissions	Nil.
Deaths	Nil.

(g) Dengue :—

Admissions	Nil.
Deaths	Nil.

7. Government dispensaries :—
(a) Number of such dispensaries, 5.
(b) Total attendances during year, 23,136.
(c) Attendances for malaria, 631.
(d) Attendances for filarial diseases, 47.
(e) Attendances for dengue, nil.

8. Medical service :—
(a) Number of Government medical officers, 11.
(b) Number of special health officers, nil.
(c) Number of other registered practitioners, 14.

9. Schools :—
(a) Number of schools, 1,527.
(b) Number of scholars registered in these schools, 119,402.
(c) Percentage of daily attendances (no record).

10. Estates employing indentured labour, nil.

11. Estimated revenue of Colony :—
Total during year, £97,355.

12. Estimated expenditure of Colony :—
(a) Total during year, £118,069.
(b) Annual medical and sanitary expenditure, £9,906.
(c) Upkeep of Government hospital and dispensaries, £676.
(d) Total salaries and allowances of medical officers, £6,500.
(e) Total annual sanitary expenditure (no separate record).

13. Towns under Municipalities or Town Councils :—
(a) Number of such, 6.
(b) Total population (no reliable record).
(c) Total revenues, about £500.
(d) Total medical and sanitary expenditure (no separate record).

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

14. Table of deaths by districts:—No record.

15. Table of deaths by towns:—

Town.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Port Herald and Chiromo ...	—	1	1	—	—	—	1	—	—	—	—	—	3
Blantyre	—	—	—	2	1	—	—	—	1	—	—	—	4
Zomba	4	—	1	2	—	—	4	1	4	3	3	1	23
Fort Johnston	1	—	—	1	—	—	1	—	—	1	—	—	4
Total	5	1	2	5	1	—	6	1	5	4	3	1	34

16. Rainfall during the year 1912:—

Where Observed.	District.	Rainfall. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
		Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Port Herald (Government Farm).	Lower Shire ...	3·05	1·38	·44	·51	·71	·39	·24	Nil.	·08	·31	1·16	15·29	23·46
Chiromo ...	Ruo	5·62	4·04	1·13	·05	·85	Nil.	·16	Nil.	·05	·50	·23	12·83	25·46
Chikwawa ...	West Shire ...	8·24	3·01	2·91	·09	·72	1·07	·33	Nil.	·60	Nil.	·92	15·80	33·69
Neno	„ „ ...	16·03	5·43	3·80	·22	·85	1·86	·12	·10	·31	·40	2·26	19·39	50·77
Mlanje ...	Mlanje ...	13·39	7·75	7·02	·73	2·56	5·91	2·51	1·61	10·98	2·71	1·35	18·27	76·79
Zomba ...	Zomba, Observatory.	11·79	10·14	2·27	·01	·61	·54	·37	·40	·37	·74	11·56	19·86	58·66
Blantyre ...	Blantyre (Government).	14·35	7·35	2·40	·34	·52	·44	·25	·12	·13	·46	1·19	9·51	37·06
Liwonde ...	Upper Shire ...	7·12	2·83	1·85	·18	·16	·19	·14	·23	·01	·07	1·97	10·76	25·51
Ncheu ...	„ „ ...	5·54	4·59	3·60	·31	1·11	·01	·74	·16	·23	·08	2·03	5·74	24·14
Fort Johnston	South Nyasa ...	5·83	4·43	1·72	·15	·04	·04	·32	Nil.	·18	·80	·97	7·08	21·56
Kawiya ...	West Nyasa ...	11·67	17·44	7·91	2·23	·81	·18	·45	·05	·16	Nil.	·58	9·99	51·47
Karonga ...	North Nyasa ...	14·42	6·92	13·84	5·73	94	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	3·47	45·32

17. Additional information:—

(*a*) Legislation against breeding of mosquitoes. Yes. Seventeen notices; nine convictions; twenty-five warnings.

(*b*) Two hundred and seventeen children examined for enlarged spleen. At Port Herald, Chiromo, Fort Johnston, and by medical officers, generally when travelling. An average of 19·7 per cent.

(*c*) Forty-seven people examined for filarial diseases. Chiromo. 7·1 per cent. Other stations, fifteen. Nil.

(*d*) Nil.

(*e*) No reliable record.

(*f*) Quinine issued gratis to European officials and to those natives who apply for it.

(*g*) To a limited extent.

(*h*) Does not apply.

(*i*) Does not arise.

(*j*) An increase in the number of cases of blackwater fever, namely 12, as compared with five in previous year.

(*k*) The above information is based on the records of the Medical Department. No returns have been received from medical practitioners, but all have been informed and invited to co-operate in the preparation of this return.

H. HEARSEY,
Principal Medical Officer

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

No. 5.

SOUTHERN NIGERIA.

RETURN OF MALARIA FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1st JANUARY TO 31st DECEMBER, 1912.

(Received in Colonial Office 1 July, 1913.)

—	Provinces.			Southern Nigeria.
	Western.	Central.	Eastern.	
1. Name of Colony—				
2. Total area	28,600 square miles.	22,670 square miles.	28,610 square miles.	79,880 square miles.
3. Estimated population :—				
(a) Total	—	—	—	8,248,536 (estimated at 5% increase on Census 1911).
(b) Europeans	585	811	409	1805 (approx.).
(c)				
(d) Other races	14	33	59	106
(e)				
4. Births during the year :—				
Total births	—	—	—	No record.
5. Deaths during the year :—				
(a) Total deaths	No record.	No record.	No record.	No reliable record.
(b) Deaths ascribed to fever ...	—	—	—	—
(c) Deaths ascribed to blackwater fever.	2	2	—	4
(d) Deaths ascribed to yellow fever	—	—	—	—
6. Government hospital :—				
(a) Number of such hospitals ...	10	15	28	53
Admissions	2,218	2,865	4,604	9,687
(b) Totals, during year :—				
Deaths	169	139	293	601
Admissions	287	334	744	1,365
(c) Malarial fever :—				
Admissions	6	7	1	14
Deaths	10	5	10	25
(d) Blackwater fever :—				
Admissions	—	—	—	—
Deaths	2	2	—	4
(e) Yellow fever :—				
Admissions	1	1	13	15
Deaths	—	—	—	—
(f) Filarial diseases :—				
Admissions	—	—	—	—
Deaths	—	1	—	1
(g) Dengue :—				
Deaths	—	—	—	—
7. Government dispensaries :—				
(a) Number of such dispensaries...	15	14	19	48
(b) Total attendances during year	34,936	28,912	28,163	92,011
(c) Attendances for malaria ...	2,975	1,828	2,171	6,974
(d) Attendances for filarial diseases	7	22	52	81
(e) Attendances for dengue ...	—	—	1	1
8. Medical service :—				
(a) Number of Government medical officers.	—	—	—	82
(b) Number of special health officers	—	—	—	3
(c) Number of other registered practitioners.	8	3	2	13
9. Schools :—				
(a) Number of Government and State-aided schools.	50	48	51	149
(b) Number of scholars registered in these schools.	7,562	7,234	6,312	21,108
(c) Percentage of daily attendances	73·77%	80·85%	67·9%	68·8%

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

—	Provinces. Western.	Provinces. Central.	Provinces. Eastern.	Southern Nigeria.
10. Estates employing indentured labour :—				
(a) Number of such	—	—	—	—
(b) Number of indentured labourers employed.	—	—	—	—
(c) Number of hospitals and dispensaries on such estates.	—	—	—	—
(d) Total deaths among such labour	—	—	—	—
(e) Deaths ascribed to malaria ...	—	—	—	—
(f) Total admissions and attendances at hospital and dispensaries.	—	—	—	—
11. Estimated revenue of Colony :—	£ s. d.	£ s. d.	£ s. d.	£ s. d.
(a) Total during year	—	—	—	1,942,467 0 0
12. Estimated expenditure of Colony :—				
(a) Total during year	—	—	—	2,042,410 0 0
(b) Annual medical and sanitary expenditure.	60,560 3 5	8,683 18 11	13,267 7 2	82,511 9 6
(c) Upkeep of Government hospital and dispensaries.	6,333 9 8	2,951 3 6	3,836 18 9	13,321 11 11
(d) Total salaries and allowances of medical officers.	—	—	—	56,359 1 7 (including native staff).
(e) Total annual sanitary expenditure.	3,260 3 5	2,048 13 10	3,075 5 2	8,384 2 5

13. Towns under municipalities or town councils :—
- (a) Number of such: One.
- (b) Total population: 73,766.
- (c) Total revenues: £26,874 16s. 5d.
- (d) Total medical and sanitary expenditure: £26,355.

14. Table of deaths by districts: No statistics.

15. Table of deaths in the principal towns :—

Town.	District where observed.	Population.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Lagos	Lagos District.	73,766	182	129	122	145	146	163	191	198	146	127	145	135	1,829
Ebute-Metta			27	26	29	24	44	35	28	23	33	22	27	28	346
Total Lagos and Ebute-Metta ...		73,766	209	155	151	169	190	198	219	221	179	149	172	163	2,175

16. Rainfall during the year :—

Where observed.	District.	Rainfall. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Western Province.		Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Lagos	Lagos ...	0·64	1·87	0·20	3·58	7·54	11·74	7·47	0·23	2·12	3·96	1·15	Nil.	40·50
Ondo	Ondo ...	0·05	4·30	5·08	8·69	5·80	13·33	9·65	1·05	10·34	5·94	3·37	Nil.	67·60
Ibadan	Ibadan ...	Nil.	Nil.	1·63	7·25	5·44	4·15	6·81	Nil.	Nil.	1·05	Nil.	1·53	27·86
Oloke-Meji ...	Abeokuta ...	0·42	0·13	3 00	7·89	6·34	5·84	6·55	0·92.	7·49	4·21	0·90	Nil.	43·69
Badagry ...	Badagry ...	0·28	0·37	*	*	6·21	13·47	8·30	0·51	2·31	1·29	2·04	0·01	34·79
Epe	Epe	Nil.	0·52	1·25	5·14	9·14	11·38	18·08	0·45	4·84	10·75	3·14	Nil.	64·69
Oshogbo ...	Oshogbo ...	0·25	0·20	1·65	4·66	5·10	5·13	6·60	0·75	5·28	7·75	2·28	Nil.	39·65
Oyo	Oyo	0·04	2·80	4·31	4·97	3·33	10·35	7·11	0·86	2·02	5·11	*	0·56	41·46
Ebute-Metta ...	Lagos ...	0·15	0·05	0·05	2·73	5·64	8·42	9·34	1·48	3·62	3·80	0·89	Nil.	36·17
Ilesha	Ilesha ...	0·24	1·22	1·89	9·91	7·43	*	*	2·59	9·26	18·42	3·27	1·50	55·73
Abeokuta ...	Abeokuta ...	0·25	Nil.	0·70	5·98	3·40	8·55	4·50	Nil.	4·69	1·53	2·12	Nil.	31·72
Ogbomosho ...	Oshogbo ...	Nil.	Nil.	1·49	5·60	4·10	2·27	5·41	*	11·29	4·24	0·76	Nil.	35·16

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November	December.	Total.
Central Province.		Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Forcados ...	Forcados ...	2·10	1·90	8·80	17·60	16·20	17·67	21·30	18·98	20·79	27·00	14·14	3·78	170·26
Sapele	Sapele ...	1·07	Nil.	2·18	13·58	9·25	18·40	11·12	11·14	15·98	11·18	2·80	Nil.	96·70
Benin City ...	Benin ...	Nil.	1·10	5·61	14·20	8·09	9·24	11·67	3·98	13·57	7·07	3·73	Nil.	78·26
Onitsha	Onitsha ...	1·77	0·20	1·65	8·28	4·36	5·92	8·67	9·55	13·35	7·23	0·47	Nil.	61·45
Warri	Warri ...	1·60	1·50	4·17	10·91	7·66	12·49	23·90	14·51	13·43	15·80	4·40	*	110·37
Aboh	Aboh ...	0·24	Nil.	2·30	9·13	6·56	12·98	20·20	14·43	18·16	17·15	2·22	Nil.	103·37
Udi	Udi	0·19	Nil.	2·81	5·56	6·43	5·15	5·40	5·13	15·50	10·97	1·58	*	58·72
Okwoga	Okwoga ...	1·85	Nil.	3·04	6·38	3·75	10·53	7·77	7·71	8·25	4·81	*	Nil.	54·09
Asaba	Asaba ...	2·36	Nil.	2·10	6·37	5·93	7·99	9·16	8·88	17·37	6·15	1·04	Nil.	67·35
Agbor	Agbor ...	†	†	†	†	†	†	15·73	5·96	12·82	8·20	3·10	*	45·81
Eastern Province.														
Bonny	Bonny ...	4·20	2·75	4·90	4·85	23·45	40·20	31·78	16·33	23·13	18·94	7·88	Nil.	178·41
Calabar	Calabar ...	Nil.	0·23	3·00	4·75	10·40	15·90	13·60	12·36	15·79	9·66	8·09	1·32	95·10
Ikot-Ekpene ...	Ikot-Ekpene	1·78	0·66	3·69	4·58	7·87	10·59	17·39	12·46	23·47	12·30	*	Nil.	94·79
Ikom	Ikom ...	0·82	Nil.	3·45	7·15	10·22	9·01	12·97	15·93	13·12	9·77	*	Nil.	82·44
Brass	Brass ...	1·22	0·74	5·95	9·25	15·94	29·79	32·28	9·75	18·73	8·37	6·50	2·28	140·80
Degema	Degema ...	0·38	Nil.	3·35	4·78	2·75	15·90	10·61	6·52	14·69	8·40	3·97	Nil.	71·35
Owerri	Owerri ...	0 31	Nil.	7·62	8·60	9·37	12·79	11·16	11·39	11·98	8·53	2·71	Nil.	84·46
Opobo	Opobo ...	1·54	2·22	12·98	2·56	8·95	31·32	29·58	20·35	16·48	7·38	6·65	0·80	140·81
Afikpo	Afikpo ...	0·30	Nil.	2·59	5·13	3·02	8·17	7·57	7·11	10 49	5·01	*	Nil.	49·39
Akassa	Akassa ...	2·60	2·67	7·34	5·85	16·11	24·52	26·08	19·91	25·76	14·53	18·31	6·92	170·60
Oban	Oban ...	1·83	0·46	6·47	14·08	22·98	10·45	18·33	19·66	26·63	*	*	*	120·89
Bende	Bende ...	1·11	Nil.	3·11	5·20	6·54	21·11	11·45	15·79	18·56	9 03	0·44	Nil.	92·39
Okigwi	Okigwi ...	†	†	†	†	†	†	†	†	†	14·50	2·20	Nil.	16·70

* No records available. † Recently established

17.—(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Yes. The Destruction of Mosquitoes Ordinance of 1910, but this Ordinance does not apply in all districts.

Number of notices served: None. Not required by law.
Number of convictions: 2,276.
Number of warnings: Very many.

(*b*) Number of children examined for enlarged spleen. Where done? 11,050, between ages of 0 and 15 years examined. Percentage with enlarged spleen, 28 per cent. (See complete spleen tables attached.) Kala-azar is not known to exist.

(*c*) Number of persons examined for filarial diseases. A few cases have been examined in Eket and Bende, but no reliable statistics are available.

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost:—

Western Province:

	£	s.	d.
Drainage	3,036	14	7
Sanitary works	2,485	9	2
Reclamation	1,138	19	7
Mosquito-proofing	1,840	3	1
Total	£8,501	6	5

Central Province:

Drainage and reclamation	2,566	0	0
Mosquito-proofing	797	0	0
Total	£3,363	0	0

Eastern Province:

Drainage	691	15	10
Reclamation	775	5	4
Mosquito-proofing	736	19	11
Total	£2,204	1	1

	£	s.	d.
Western Province	8,501	6	5
Central Province	3,363	0	0
Eastern Province	2,204	1	1
	£14,068	7	6

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.

Numbers of men employed:—		Approximate cost:— £	s.	d.
Western Province,	109	2,844	17	6
Central Province,	77	1,353	12	0
Eastern Province,	53	803	0	0
Southern Nigeria,	239	£5,001	9	6

(*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed:—

Western Province	816,240	grains.
Central Province	355,448	,,
Eastern Province	301,286	,,
Southern Nigeria	1,472,974	,,

(*g*) Is quinine distributed regularly in the schools? No.

(*h*) Measures taken against these diseases on estates employing indentured labour. No such estates.

(*i*) Any steps taken regarding the housing of the poor? No.

(*j*) Any exceptional increase or decrease of these diseases recently noticed? No.

(*k*) Any other remarks. None.

W. H. LANGLEY,
Principal Medical Officer.

31 May, 1913.

SPLEEN RETURNS, 1912.

Western Province.

District.	Ages of those examined.	0–2 years.	2–5 years.	5–10 years.	10–15 years.	15–20 years.	20–30 years.	30–40 years.	Over 40 years.	Totals.	Percentages.
Aro	Number examined ...	17	12	—	—	—	—	—	—	29	—
	Normal ... per cent.	41	41	—	—	—	—	—	—	12	41·5
	Slightly enlarged ,,	59	59	—	—	—	—	—	—	17	58·5
	Enlarged beyond Costal Margin. ,,	—	—	—	—	—	—	—	—	—	—
Badagry ...	Number examined ...	13	25	31	—	11	22	34	—	136	—
	Normal ... per cent.	23	20	32	—	45	68	62	—	59	43
	Slightly enlarged ,,	15	8	36	—	—	9	15	—	22	16·5
	Enlarged beyond Costal Margin. ,,	62	72	32	—	55	23	23	—	55	40·5
Epe	Number examined ...	29	50	33	10	1	—	—	—	123	—
	Normal ... per cent.	72	62	73	40	100	—	—	—	81	65·8
	Slightly enlarged ,,	24	36	27	60	—	—	—	—	40	32·6
	Enlarged beyond Costal Margin. ,,	4	2	—	—	—	—	—	—	2	1·6

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

District.	Ages of those examined.	0–2 years.	2–5 years.	5–10 years.	10–15 years.	15–20 years.	20–30 years.	30–40 years.	Over 40 years.	Totals.	Per-centages.
Ibadan ...	Number examined ...	64	130	161	115	46	8	—	—	524	—
	Normal ... per cent.	64	52	61	72	93·5	100	—	—	341	65
	Slightly enlarged „	—	19	24	15	—	—	—	—	81	16
	Enlarged beyond Costal Margin. „	36	29	15	13	6·5	—	—	—	102	19
	Central Province.										
Aboh ...	Number examined ...	43	94	110	84	13	53	—	—	397	—
	Normal ... per cent.	70	60	60	65·5	38	62	—	—	246	62
	Slightly enlarged „	18·5	31	14·5	14·5	46·5	26	—	—	85	22
	Enlarged beyond Costal Margin. „	11·5	9	25·5	20	15·5	12	—	—	66	16
Agbor ...	Number examined ...	25	46	66	19	—	106	13	10	285	—
	Normal ... per cent.	88	70	73	47	—	61	100	100	199	70
	Slightly enlarged „	12	19	24	32	—	35	—	—	71	25
	Enlarged beyond Costal Margin. „	—	11	3	21	—	4	—	—	15	5
Benin City...	Number examined ...	27	358	366	180	42	26	—	—	999	—
	Normal ... per cent.	33	56	54	74	55	31	—	—	568	57
	Slightly enlarged „	52	22	27	15	26	42	—	—	242	24
	Enlarged beyond Costal Margin. „	15	22	19	11	19	27	—	—	189	19
Forcados ...	Number examined ...	70	25	24	52	135	504	88	14	912	—
	Normal ... per cent.	6	12	21	17	29	24	27	50	213	23
	Slightly enlarged „	46	64	66	68	66	66	64	50	584	64
	Enlarged beyond Costal Margin. „	48	24	13	15	5	10	9	—	115	13
Okwoga ...	Number examined ...	11	11	30	11	1	40	1	—	105	—
	Normal ... per cent.	—	—	—	45·5	—	77·5	100	—	37	35
	Slightly enlarged „	27	64	83	54·5	100	22·5	—	—	51	49
	Enlarged beyond Costal Margin. „	73	36	17	—	—	—	—	—	17	16
Onitsha ...	Number examined ...	44	39	28	18	—	—	—	—	129	—
	Normal ... per cent.	—	—	—	—	—	—	—	—	—	—
	Slightly enlarged „	75	79	68	78	—	—	—	—	97	75
	Enlarged beyond Costal Margin. „	25	21	32	22	—	—	—	—	32	25
Sapele ...	Number examined ...	80	46	111	85	35	6	12	—	375	—
	Normal ... per cent.	25	19·5	32	51	66	67	75	—	143	38
	Slightly enlarged „	27·5	28·5	33	28	11	16·5	8	—	102	27
	Enlarged beyond Costal Margin. „	47·5	52	35	21	23	16·5	17	—	130	35

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

District.	Ages of those examined.	0–2 years.	2–5 years.	5–10 years.	10–15 years.	15–20 years.	20–30 years.	30–40 years.	Over 40 years.	Totals.	Percentages.
Udi	Number examined ...	2	24	93	11	—	—	—	—	130	—
	Normal ... per cent.	—	—	49	64	—	—	—	—	53	41
	Slightly enlarged „	—	12	12	18	—	—	—	—	16	12
	Enlarged beyond Costal Margin. „	100	88	39	·18	—	—	—	—	61	47
Warri ...	Number examined ...	6	10	1	—	—	2	—	—	19	—
	Normal ... per cent.	—	—	—	—	—	—	—	—	—	—
	Slightly enlarged „	33·3	—	—	—	—	—	—	—	2	10·5
	Enlarged beyond Costal Margin. „	66·6	100	100	—	—	100	—	—	17	89·5
	Eastern Province.										
Abakaliki ...	Number examined ...	8	3	11	5	8	29	36	—	100	—
	Normal ... per cent.	12·5	—	9	60	37·5	58	88	—	57	57
	Slightly enlarged „	87·5	—	36	—	37·5	35	9	—	27	27
	Enlarged beyond Costal Margin. „	—	100	55	40	25	7	3	—	16	16
Afikpo ...	Number examined ...	71	141	168	121	97	181	159	—	938	—
	Normal ... per cent.	52	57	62	71	84	73	85	—	654	70
	Slightly enlarged „	38	33	27	21	12	20	10	—	210	22
	Enlarged beyond Costal Margin. „	10	10	11	8	4	7	5	—	74	8
Bende ...	Number examined ...	131	690	2,709	2,001	1,111	1,871	3,975	—	12,488	—
	Normal ... per cent.	51·2	91	90	91	94	96	96	—	11,655	93
	Slightly enlarged „	42·2	8	8	7	5·5	3·7	3·7	—	701	6
	Enlarged beyond Costal Margin. „	6·6	1	2	2	·5	·3	·3	—	132	1
Bonny ...	Number examined ...	45	44	25	36	16	12	4	—	182	—
	Normal ... per cent.	51·2	52·5	48	50	44	25	100	—	90	49
	Slightly enlarged „	42·2	43	52	39	44	58·3	—	—	79	44
	Enlarged beyond Costal Margin. „	6·6	4·5	—	11	12	16·6	—	—	13	7
Brass ...	Number examined ...	18	17	11	10	3	32	29	—	120	—
	Normal ... per cent.	72	47	73	50	33·3	78	69	—	80	67
	Slightly enlarged „	17	12	9	—	—	—	3·5	—	7	6
	Enlarged beyond Costal Margin. „	11	41	18	50	66·6	22	27·5	—	33	27
Degema ...	Number examined ...	21	31	45	41	46	95	349	—	628	—
	Normal ... per cent.	10	—	9	10	13	17	54	—	220	35
	Slightly enlarged „	57	52	57·7	68	74	67	44·2	—	335	53
	Enlarged beyond Costal Margin. „	33	48	33·3	22	13	16	1·8	—	73	12

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

District.	Ages of those examined.	0–2 years.	2–5 years.	5–10 years.	10–15 years.	15–20 years.	20–30 years.	30–40 years.	Over 40 years.	Totals.	Percentages.
Ikom-Obubra	Number examined ...	1	21	50	46	38	101	110	—	367	—
	Normal ... per cent.	—	19	44	54·3	60·5	50	40	—	169	46
	Slightly enlarged „	100	5	12	4·3	—	5	2	—	17	5
	Enlarged beyond Costal Margin. „	—	76	44	41·3	39·5	45	58	—	181	49
Ikot-Ekpene	Number examined ...	14	18	45	66	22	5	454	—	624	—
	Normal ... per cent.	36	22	24	26	27	100	32	—	193	31
	Slightly enlarged „	21	45	40	47	36·5	—	43	—	265	42
	Enlarged beyond Costal Margin. „	43	33	36	27	36·5	—	25	—	166	27
Itu	Number examined ...	2	15	163	60	64	118	95	4	521	—
	Normal ... per cent.	—	—	43	35	35	52	52	75	226	43
	Slightly enlarged „	100	53·2	19	14·9	42	36	41	—	159	31
	Enlarged beyond Costal Margin. „	—	46·8	38	50·1	33	12	7	25	136	26
Okigwi ...	Number examined ...	18	21	16	56	56	111	114	—	392	—
	Normal ... per cent.	89	86	93·7	68	64	88	70	—	300	77
	Slightly enlarged „	5·5	14	6·3	16	29	8	25	—	67	17
	Enlarged beyond Costal Margin. „	5·5	—	—	16	7	4	5	—	25	6
Opobo ...	Number examined ...	2	12	4	—	8	15	77	—	118	—
	Normal ... per cent.	—	83·3	25	—	75	80	79	—	90	76
	Slightly enlarged „	50	—	25	—	12·5	20	21	—	22	19
	Enlarged beyond Costal Margin. „	50	16·7	50	—	12·5	—	—	—	6	5
Owerri ...	Number examined ...	193	273	305	306	269	412	418	—	2,176	—
	Normal ... per cent.	76	73	73	77	81	83	74	—	1,674	77
	Slightly enlarged „	20	24	20·5	18	17	15	20	—	414	19
	Enlarged beyond Costal Margin. „	4	3	6·5	5	2	2	6	—	88	4
Western Province.	Number examined ...	123	217	225	125	58	30	34	—	812	—
	Normal ... per cent.	58·5	50·2	58·7	69·6	84·5	76·6	61·8	—	493	60·7
	Slightly enlarged „	15·5	24	26·2	18·4	—	6·6	14·7	—	160	19·7
	Enlarged beyond Costal Margin. „	26	25·8	15·1	12	15·5	16·6	23·5	—	159	19·6
Central Province.	Number examined ...	308	653	829	460	226	737	114	24	3,351	—
	Normal ... per cent.	27·6	46·1	47·8	56·5	39·8	35·7	41·2	70·8	1,459	43·5
	Slightly enlarged „	38	28·5	29	27·6	49·1	55	50	29·2	1,250	37·3
	Enlarged beyond Costal Margin. „	34·4	25·4	23·2	15·9	11·1	9·3	8·8	—	642	19·2

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

District.	Ages of those examined.	0–2 years.	2–5 years.	5–10 years.	10–15 years.	15–20 years.	20–30 years.	30–40 years.	Over 40 years.	Totals.	Percentages.
Eastern Province.	Number examined ...	524	1,286	3,552	2,748	1,738	2,982	5,820	4	18,654	—
	Normal ... per cent.	70·4	76	81·5	82·8	83·5	85·6	84	75	15,408	82·6
	Slightly enlarged „	23·1	17·3	12·1	11·6	12·4	10·5	11·7	—	2,303	12·35
	Enlarged beyond Costal Margin. „	6·5	6·7	6·4	5·6	4·1	3·9	4·3	25	943	5·05
Southern Nigeria.	Number examined ...	955	2,156	4,606	3,333	2,022	3,749	5,968	28	22,817	—
	Normal ... per cent.	55·1	64·3	74·3	78·6	78·6	73·7	83	71·4	17,360	76·1
	Slightly enlarged ...	26·9	21·4	15·8	14	16·1	19·1	12·5	25	3,713	16·2
	Enlarged beyond Costal Margin. „	18	14·3	9·9	7·4	5·3	5·2	4·5	3·6	1,744	7·7

No. 6.

UGANDA PROTECTORATE.

RETURN OF STATISTICS ON THE SUBJECT OF THE PREVENTION OF MOSQUITO-BORNE DISEASES FOR THE YEAR ENDING 31st DECEMBER, 1912.

(Received in Colonial Office April 12, 1913.)

1. Name of Colony: Uganda Protectorate.
2. Total area: 117,681 square miles (taken from Census Return April, 1911).
3. Estimated population:

Europeans	640
Asiatics	2,216
Natives	2,840,469
Total	2,843,325

4. Births:

Europeans	30
Asiatics	12
Natives	30,471
Total	30,513

5. Deaths:

Europeans	8
Asiatics	37
Natives	27,151
Total	27,196

Deaths attributed to fever:

Europeans	1
Others	4,562
Total	4,563

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

Deaths attributed to blackwater fever:

Europeans	3
Others	5
Total	8

Deaths attributed to yellow fever ... ... None.

6. Government Hospitals:

(a) Number	16
(b) Admissions:	
Europeans	51
Asiatics and natives	2,282
Total	2,333
(c) Malarial fevers:	
Admissions:	
Europeans	12
Asiatics and natives	320
Total	332
Deaths:	
Europeans	Nil
Asiatics and natives	8
Total	8
(d) Blackwater fever:	
Admissions:	
Europeans	1
Asiatics and natives	10
Total	11
Deaths:	
Europeans	Nil
Asiatics and natives	2
Total	2

(e) Yellow fever, no cases.
(f) Filarial diseases, 1.
(g) Dengue fever, nil.

7. Government Dispensaries:
(a) Number of dispensaries, 17.
(b) Total attendances during year, 97,650.
(c) Total attendances for malaria, 6,239.
(d) Total attendances for filarial diseases, 17.
(e) Total attendances for dengue fever, 5.

8. Medical service:
(a) Number of Government Medical Officers:
One Principal Medical Officer, one Deputy Principal Medical Officer, one Medical Sanitary Officer, and fifteen Medical Officers. In addition to above there were four temporary Medical Officers employed on special sleeping sickness investigation, and two dealing specially with venereal diseases.
(b) Number of special Health Officers:
The Medical Sanitary Officer above-mentioned. This officer was appointed during the year.
(c) Number of other registered practitioners, 3.

9. Schools :
   (*a*) Number of Government and State-aided schools :
      There are no Government or specially State-aided schools. Annual educational grants are made to three missionary societies and certain special grants for scholarships, &c.
      Number of schools, 126.
   (*b*) Numbers of scholars registered, 19,082.
   (*c*) Percentage of daily attendance, 60·76.

10. Estates employing indentured labour :
   There is no indentured labour on estates in this Protectorate.

11. Estimated revenue, £231,794.

12. Estimated expenditure :
   (*a*) Total during the year, £313,799.
   (*b*) Annual medical and sanitary expenditure, £10,635.
   (*c*) Upkeep of Government hospitals and dispensaries, £6,902.
   (*d*) Total salaries and allowances to Medical Officers, £8,951.
   (*e*) Total annual sanitary expenditure :
      Sanitary service in permanent stations, £995.
      Upkeep of stations, £2,836.

13. Towns under Municipalities or Town Council :
   None, but the following stations are now under control of local Sanitary Committees, consisting of the District Officer, the Medical Officer, and the District Engineer, viz., Entebbe, Kampala, Jinja, Hoima, Mbale, Mbarara, and Masindi.

14. Table of deaths by districts :
   (Attached.)

15. Table of deaths in principal towns :
   Not obtainable.

16. Rainfall :
   (Table attached.)

17. Additional information :
   (*a*) Rules are in force at Entebbe, Kampala, and Jinja under the Township Ordinance permitting a public officer or other duly authorised persons to enter premises for the purposes of seeing that rules under Township Ordinance are duly performed and observed, and also others imposing penalties on persons failing to keep their water receptacles free from mosquito larvæ.

Notices, warnings, convictions, &c. :

Station.	No. of Notices.	No. of Warnings.	No. of Convictions.
Entebbe	2	2	Nil.
Kampala	13	Nil.	Nil.
Jinja	42	Nil.	Nil.
Total	57	2	Nil.

   (*b*) Number of children examined for enlarged spleen :
      No record.
   (*c*) Number of persons examined for filarial diseases :
      No record.
   (*d*) Any large works for surface drainage of towns or reclamation of marshes :
      No new large works for surface drainage have been undertaken during the year, but the existing drainage of swamps at Kampala and Masindi have been maintained in good order and drainage of the swamp at Butiaba has been started.

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

(*e*) Number of men employed in towns and villages for petty anti-mosquito work :

Anti-malarial gangs, consisting of from 6 to 12 men, have been employed at all the principal stations in collecting old tins, broken bottles, &c., from compounds, clearance of rain guttering, filling in rain holes, removing of long grass and planting of French grass in its place, examination of water vessels for mosquito larvæ, &c., &c.

These gangs were supplemented by the station staffs. Prison labour was also frequently employed on petty anti-malarial measures.

£600 was sanctioned in Estimates for epidemics and anti-malarial measures, of which £321 has been spent on the last-named service.

(*f*) Amount of Government quinine sold or distributed gratis during the year; agencies employed :

5 gr. tabloids and tablets, number, 55,800.

Quinine in powder, 177 lbs. 15 ozs.

Agencies employed—Government dispensaries.

(*g*) Is quinine distributed regularly in schools?

No, only in certain schools when children have fever.

(*h*) Measures taken against these diseases :

Employment of anti-mosquito gangs in townships Clearance of grass and undergrowth in townships and compounds. Periodical inspection of compounds for empty tins, broken bottles, &c., mosquito larvæ in water vessels, guttering, &c., planting of short French grass, improved wire gauze protection to houses, instruction of military and police in anti-mosquito work, and the distribution of anti-mosquito literature. No measures in native shambas.

(*i*) Housing of the poor :

No measures.

(*j*) Any exceptional increase or decrease of these diseases recently noticed :

None.

(*k*) Any further information which may become available will be embodied in the Annual Medical and Sanitary Report for 1912.

C. A. WIGGINS,
for Principal Medical Officer, Uganda Protectorate.

Entebbe,
Uganda,
5th March, 1913.

Uganda Protectorate.

Return showing Deaths among Europeans, Asiatics, and Natives each Month during 1912, by Districts.

District.	Area in square miles.	Population.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Buganda ...	16,393	670,000	910	844	790	911	985	1,205	1,086	1,054	991	916	843	885	11,420
Easter Province.	13,800	1,026,000	662	602	696	522	660	715	708	566	584	702	592	522	7,522
Bunyoro ...	4,900	170,000	111	91	123	86	79	96	233	332	321	310	314	356	2,452
Toro	6,000	100,000	216	218	241	215	147	267	181	164	187	154	202	142	2,334
Ankole ...	4,800	250,000	269	221	228	204	331	285	494	267	300	230	250	273	3,352
Sleeping Sickness Camp.	—	—	5	11	8	5	16	6	10	16	11	9	6	10	113
Unadministered Areas, &c.	27,426	400,000	—	—	—	—	1	—	1	—	—	1	—	—	3*
						Returns of native deaths not available.									
Totals ...	73,319	2,616,000	2,173	1,987	2,086	1,943	2,219	2,565	2,713	2,399	2,394	2,322	2,207	2,188	27,196

* 2 Europeans, 1 Asiatic.

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

Uganda Protectorate.

Comparative Rainfall Statement, showing the Monthly Rainfall for the Year 1912 of forty-one localities of Uganda Protectorate.

Month.	Entebbe.		Nimule.		Jinja.		Mbarara.		Masaka.		Gondokoro.		Fort Portal.		Butiaba.		Masindi.	
	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.
January	3·55	8	0·02	1	1·66	6	3·33	9	0·62	5	Nil.	Nil.	0·25	1	1·81	4	0·95	4
February ...	3·59	10	3·20	3	4·24	11	2·26	11	2·09	11	0·75	1	1·03	3	2·13	4	4·09	5
March	8·61	18	1·37	7	5·64	13	1·19	7	3·51	16	1·22	10	3·95	9	2·36	4	1·13	2
April	7·55	18	1·10	5	7·03	21	8·26	19	6·96	20	1·97	8	8·35	10	3·90	9	3·76	9
May	12·03	18	2·66	7	3·65	13	0·34	4	2·34	14	3·79	11	8·82	10	5·26	5	5·14	7
June	9·81	15	1·26	10	2·98	11	Nil.	Nil.	1·12	4	2·70	7	1·21	4	4·88	5	8·50	7
July	2·61	9	3·55	14	2·89	5	1·16	4	0·20	3	6·12	12	1·51	4	3·09	6	4·00	5
August	6·75	17	2·57	11	4·60	13	2·81	7	2·91	14	4·02	9	6·07	11	4·47	4	4·40	8
September ...	2·08	7	2·63	8	1·04	6	6·41	13	1·64	9	*	*	3·67	7	8·33	7	3·74	5
October	0·96	14	1·86	5	4·98	14	4·75	14	2·49	14	*	*	6·35	17	1·92	5	5·20	6
November ...	8·22	18	7·07	7	3·99	14	3·44	16	3·90	17	*	*	8·63	14	5·00	7	7·43	8
December ...	9·95	20	*	*	4·62	12	1·21	6	2·65	14	*	*	3·29	7	Nil.	Nil.	*	*
Total ...	75·71	172	—	—	47·32	139	35·16	110	30·43	141	20·57	58	53·13	97	43·15	60	—	—

* Not available.

Month.	Gulu.		Kampala.		Mbale.		Mubendi.		Budo.		Bukona.		Namenage.		Nabieso	
	In.	No. of days.	In.	No. of days.	In	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.
January	0·33	2	3·12	11	0·26	5	1·16	5	2·46	7	1·40	4	1·71	6	0·28	2
February	3·15	6	2·57	12	7·10	10	8·68	12	1·22	5	6·96	10	4·11	4	4·20	9
March	3·16	4	8·39	26	4·66	12	6·53	10	5·17	13	4·00	16	3·17	11	2·87	9
April	5·97	12	5·73	27	8·65	16	7·93	14	5·68	12	14·87	19	9·86	19	4·56	16
May	8·68	11	4·54	24	*	*	1·39	4	4·46	10	3·87	13	3·69	15	3·64	12
June	9·10	15	3·00	20	4·14	15	0·34	1	7·98	12	1·30	10	3·01	14	3·03	14
July	6.17	14	2·65	15	6·86	18	1·76	7	1·35	7	3·68	17	3·54	10	2·22	13
August	9·57	16	10·39	18	5·74	24	3·22	8	5·93	12	6·01	14	3·59	14	3·27	14
September	5·03	8	1·96	13	9·06	20	5·40	8	4·77	10	6·65	12	6·21	9	9·50	13
October	6·16	10	6·21	21	3·63	17	2·94	6	4·12	8	4·76	14	4·88	11	7·37	18
November	7·35	11	3·07	23	4·10	17	4·51	11	2·75	11	5·06	17	5·34	10	2·63	11
December	0·40	4	5·13	21	0·47	7	2·42	5	4·21	12	2·88	11	2·18	6	0·25	1
Total	65·07	113	56·76	231	54·67	161	46·28	91	50·10	119	61·44	157	51·29	129	43·82	132

Month.	Kumi.		Hoima.		Namukekera.		Nabumali.		Iganga.		Butiti.		Bukumi.		Mitala Mariya.	
	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.
Jauuary	Nil	—	1·61	5	2·08	5	0·17	5	1·37	1	1·36	3	1·81	6	1·35	5
February	4·69	6	2·62	14	7·81	9	—	—	4·97	5	2·59	7	5·71	8	2·62	5
March	4·12	11	3·55	14	4·66	8	2·79	15	4·65	7	4·05	8	4·055	17	5·10	12
April	12·84	19	6·81	17	5·93	16	10·23	26	—	—	3·74	8	6·22	13	7·60	17
May	6·50	14	7·88	16	3·72	13	4·94	19	2·85	10	3·79	8	2·61	11	6·63	10
June	3·33	8	1·33	7	1·33	9	4·30	18	2·32	7	0·92	4	1·23	4	2·87	11
July	6·43	11	6·99	12	1·19	3	5·53	22	2·77	4	4·14	9	4·49	11	1·61	9
August	6·28	13	6·72	16	7·27	13	7·24	27	8·78	14	4·48	12	6·57	16	5·90	17
September	3·13	8	5·25	12	4·99	10	3·19	16	2·97	7	4·71	9	4·30	11	*	*
October	4·27	12	6·56	15	4·44	12	2·53	25	7·18	11	5·51	14	4·97	9	*	*
November	1·45	8	5·09	17	6·69	17	1·98	17	6·58	16	5·88	17	6·14	10	*	*
December	0·42	2	1·48	3	*	*	1·85	13	1·14	5	0·74	7	3·76	4	*	*
Total	53·46	112	55·89	148	—	—	44·75	203	45·58	87	41·91	106	51·865	120	33·68	86

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

Month.	Rubaga.		Ngora.		Kisubi.		Kivuvu.		Kawalon-gojo.		Magigye.		Nandere.		Moniko.	
	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.
January	4·04	9	1·28	5	1·36	5	3·33	6	2·65	10	4·48	4	2·80	6	2·60	5
February	1·44	8	9·63	11	2·55	9	2·32	10	2·58	10	2·63	6	3·00	6	3·94	9
March	7·72	17	3·60	8	12·77	17	5·51	17	4·99	18	5·14	11	7·98	15	6·44	17
April	6·28	12	8·09	17	6·79	19	6·90	20	5·74	17	5·83	14	5·49	21	6·84	19
May	4·275	11	8·51	16	10·64	15	5·13	13	8·22	17	2·54	8	6·17	16	6·00	17
June	2·47	12	2·65	9	5·80	17	4·39	12	1·25	8	2·40	5	3·54	9	4·59	14
July	3·60	9	5·24	13	2·34	10	2·39	11	5·08	4	3·40	5	2·83	13	2·82	12
August...	7·71	12	6·90	*	9·69	13	3·11	13	*	*	7·85	15	8·78	21	3·82	13
September	1·52	4	2·73	8	2·16	7	5·32	12	3·45	12	3·56	3	4·12	13	3·51	13
October	6·31	16	3·83	14	1·00	11	5·99	14	5·32	14	2·36	6	5·34	17	6·04	12
November	4·10	10	2·23	8	3·94	13	3·71	15	3·13	15	2·68	10	3·87	16	4·42	12
December	6·02	13	0·75	4	7·33	17	2·05	12	4·57	16	5·00	12	3·38	10	2·59	9
Total	55·485	133	55·44	113	66·37	153	50·15	155	46·98	141	47·87	99	57·30	63	53·61	152

Month.	Kiritia.		Bombo.		Bwavu.		Bugalla Island (Sesse).		Sango Bay.		Mvuba.		Kakumiro.		Bunyaru-guru.	
	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.
January	*	*	4·97	9	0·80	4	*	*	*	*	*	*	*	*	*	*
February	*	*	4·35	9	5·32	8	*	*	—	—	*	*	*	*	*	*
March	*	*	8·44	15	9·42	18	6·175	20	6·38	12	*	*	*	*	*	*
April	7·69	11	8·81	24	5·65	14	10·94	18	9·80	17	*	*	*	*	*	*
May	4·60	12	5·30	17	5·39	18	11·00	19	*	*	*	*	*	*	*	*
June	4·22	8	1·87	14	2·94	12	13·42	18	*	*	*	*	*	*	*	*
July	1·87	4	2·21	12	2·91	8	4·45	18	*	*	2·35	6	*	*	*	*
August...	2·74	7	3·90	25	1·94	11	5·03	11	*	*	6·28	11	*	*	*	*
September	1·89	9	2·27	13	4·73	13	2·10	12	*	*	5·57	12	*	*	*	*
October	6·48	11	2·97	16	4·97	15	4·47	12	*	*	0·75	4	3·01	16	*	*
November	3·97	12	5·94	13	3·57	16	8·57	21	*	*	3·48	9	6·06	14	7·95	11
December	2·44	9	1·42	11	3·91	13	12·72	27	*	*	*	*	1·10	7	5·28	19
Total	35·90	83	52·45	178	51·55	150	78·875	176	16·18	29	—	—	10·17	37	13·23	30

* Not available.

No. 7.

ZANZIBAR.

The VICE-CONSUL to the TROPICAL DISEASES RESEARCH FUND.

(Received 8 August, 1913.)

Sir,

Zanzibar, July 9, 1913.

I am directed by the Acting British Agent and Consul-General to transmit herewith, for your information, a report for the year 1912 on the prevention of mosquito-borne diseases which has been prepared by the Medical Officer of Health to the Zanzibar Government.

I have, &c.,
G. B. BEAK,
His Britannic Majesty's Vice-Consul.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

Enclosure in No. 7.

Sir, Health Office, Zanzibar, 4th July, 1913.

I have the honour to forward to you a report for the year 1912 on the prevention of mosquito-borne diseases.

I should be glad if you would forward this report to the Secretary of the Advisory Committee for the Tropical Diseases Research Fund.

It will be seen from the figures I have given that mosquito-borne diseases are responsible for—

16·7 per cent. of the total deaths.
21·5 per cent. of the total admissions to hospitals.
(For the year 1911 the figure was 25 per cent.)
6·5 per cent. of the total attendances at dispensaries.
(For the year 1911 the figure was 9 per cent.)

The figures taken from the hospital records are, I think, sufficiently large to allow the conclusion to be drawn that the mortality rate for mosquito-borne diseases shows an appreciable, and, therefore, satisfactory, fall for the year 1912 as compared with 1911. At the same time the number of cases of elephantiasis that come to notice, though not necessarily to hospital, is lamentably large.

The number of deaths certified as being due to malarial fever in Zanzibar Town has remained practically constant for the past five years, but it is to be hoped that this figure will show some signs of falling as the result of the work of the larger anti-mosquito brigade which it is proposed to organise in 1913.

I have, &c.,
D. S. Skelton, Captain,
Royal Army Medical Corps,
(Medical Officer of Health).

The First Minister,
Zanzibar Government.

Report on Mosquito-Borne Diseases. (January 1st to December 31st, 1912.)

1. Name of Protectorate : Zanzibar (including Pemba).
2. Total area of both islands : 1,020 square miles.
3. Estimated population (Census, 1910) :

(*a*) Total	197,199
(*b*) Europeans	234
(*c*) Indian and Cingalese	8,305
(*d*) Other races	188,660

4. Births during the year :

(*a*) Total births	2,832

5. Deaths during the year :

——	Europeans.	Other Races.	Total.
(*a*) Total deaths	3	5,189	5,192
(*b*) Deaths ascribed to fever	—	858	858
(*c*) Deaths ascribed to blackwater	—	2	2
(*d*) Deaths ascribed to yellow fever	—	—	—

6. Hospitals :

(*a*) Number of hospitals	Government	6
	Private (U. M. C. A.) ...	1
	Total	7

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

—	Government Hospital.		U.M.C.A.		Total.		Grand Total.
	Europeans.	Other Races.	Europeans.	Other Races.	Europeans.	Other Races.	
(*b*) Total during the year :—							
Admissions	6	2,132	31	185	37	2,317	2,354
Deaths	2	66	—	10	2	76	78
(*c*) Malarial fever :—							
Admissions	4	369	12	32	16	401	417
Deaths	—	—	—	—	—	—	—
(*d*) Blackwater fever :—							
Admissions	—	3	—	—	—	3	3
Deaths	—	1	—	—	—	1	1
(*e*) Yellow fever :—							
Admissions	—	—	—	—	—	—	—
Deaths	—	—	—	—	—	—	—
(*f*) Filarial diseases :—							
Admissions	—	62	—	24	—	86	86
Deaths	—	1	—	—	—	1	1
(*g*) Dengue :—							
Admissions	—	—	—	—	—	—	—
Deaths	—	—	—	—	—	—	—

7. Dispensaries :

(*a*) Number of dispensaries	Government	...	7
	Private, Khoja ...	1	
	U. M. C. A.	2	
		—	3
	Total... ...		10

—	Government		Private.		Total.		Grand Total.
	Europeans.	Other Races.	Europeans.	Other Races.	Europeans.	Other Races.	
(*b*) Total attendances during year ...	30	18,437	—	33,085	30	51,522	51,552
(*c*) Attendances for malaria ...	—	754	—	2,015	—	2,769	2,769
(*d*) Attendances for filarial diseases	—	506	—	57	—	563	563
(*e*) Attendances for dengue ...	—	—	—	—	—	—	—
(*f*) Attendances for blackwater fever.	—	—	—	1	—	1	1

8. Medical service :
 (*a*) Number of Government medical officers 5
 (*b*) Number of special health officers 2
 (*c*) Number of other registered practitioners 6

9. Schools :
 (*a*) Number of Government and State-aided schools ... 6
 (*b*) Number of scholars registered in the schools ... 452
 (*c*) Percentage of daily attendance ... ... 79·5

10. There are no estates employing indentured labour.

11. Estimated revenue of the Protectorate :
 (*a*) Total revenue during the year £189,282

12. Estimated expenditure of the Protectorate : £
 (*a*) Total during the year 208,671
 (*b*) Annual medical and sanitary expenditure 18,968
 (*c*) Upkeep of Government hospitals and dispensaries ... 8,716

	£
(*d*) Total salaries and allowances of medical officers ...	3,086
(*e*) Total annual sanitary expenditure	10,252*

13. No towns under municipalities.

14. Table of deaths by districts..

Districts.	Number of deaths	Total.
Island of Zanzibar.		
Zanzibar Town	1,284	
Mkokotoni	1,118	
Chwaka	706	
Mwera	1,071	
		4,179
Island of Pemba.		
Chake Chake	495	
Weti	357	
M'Koani	161	
		1,013
Total for both islands ...		5,192

15. Table of deaths in principal towns (see No. 14).

16. Rainfall during the year :

January	4·36
February	6·99
March	7·39
April	13·09
May	3·45
June	0·47
July	0·03
August	1·04
September	6·59
October	0·98
November	5·17
December	17·82
Total	67·91 inches.

Average ... 77·03

17. Additional information to be given, if possible, on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—Yes. Under the Public Health Decree. "Any collection of water in any well, pool, channel, barrel, tub, bucket, or any other vessel, and found by the Health Officer to contain mosquito larvæ, shall be nuisances liable to be dealt with under this decree."

A strong mosquito brigade is about to be organised, and anti-mosquito measures will be started on a more systematic plan next year.

Number of notices during the year	228
Number of convictions	7
Number of warnings	383

(*b*) Number of persons of the age of 15 examined for enlarged spleen ... ... Nil.

Does Kala-azar exist?—Not known to exist.

(*c*) Number of persons examined for filarial diseases? ... 7

Where was this done?—Health Office laboratory.

Percentage affected? ... ... 42·85

* Including the upkeep of leper and poor establishments and of the quarantine station.

(*d*) Large works for surface drainage of towns and reclamations of swamps.
A ravine within short distance of the town, in which there was permanent water, and in which anopheles were constantly found, was thoroughly drained by a concrete channel at a cost of Rs. 12,000. The result is that water can no longer collect there, and even in the rainy season the ravine is mosquito free.

(*e*) Number of men employed in town for petty anti-mosquito work.
In Zanzibar Town three trained men are employed as inspectors. Approximate cost, 960 rupees per annum. In Pemba the Sanitary Inspector goes round once in a week.

(*f*) Amount of Government quinine sold or distributed gratis during the year.
None; but in 1913 it is contemplated making it compulsory on all Government employees to take 10 grains of quinine twice a week. This will be done under the supervision of the Health Office. Further, quinine in packets will be distributed widely to headmen for use in the villages.

(*g*) Is quinine regularly distributed in the schools?—Not at present, but it will be given in 1913. It is proposed to give tannate of quinine in chocolate tabloid form.

(*h*) Not applicable. There is no indentured labour.

(*i*) Housing of the poor.—Wherever possible insanitary native huts in Zanzibar are being demolished. Efforts are being made to prevent overcrowding of the numerous Indian lodging-houses.

(*j*) Increase or decrease in the diseases noted.—The number of deaths ascribed to fever shows a large increase over that of 1911. This is due to a stricter attention being paid to the official nomenclature of diseases.

(*k*) Any other remarks on the subject.—*Vide* introductory remarks.

No. 8.

NORTHERN RHODESIA.

REPORT BY THE PRINCIPAL MEDICAL OFFICER ON MOSQUITO-BORNE DISEASES, 1912.

(Received 7 October, 1913.)

Medical Department, Livingstone, Northern Rhodesia,
5th September, 1913.

SIR,

I HAVE the honour to forward herewith the report asked for on mosquito-borne diseases in this territory.

I very much regret the delay in doing so, which was due to the fact that in the first place the annual reports from the various District Medical Officers had not been received at the time this report was originally asked for (the year ending March 31st being adopted in this territory as the period on which annual reports are written), and also to the fact that I hesitated to attempt to provide information necessarily so defective in detail.

Information is asked for on the subject of malarial fever, blackwater fever, yellow fever, filariasis, and dengue. Of these diseases yellow fever and dengue are not known in this territory.

Filariasis has not been known to have occurred in a European.

The amount of malarial fever in Europeans can only be judged by the hospital returns given below. These can be taken only as an indication of the extent of the disease, *i.e.*, those cases which came under medical treatment. It may, I think, be stated as a rough estimate that, with the exception of the Lusakas District, previously reported on, this number probably represents 50 per cent. of the Europeans who suffered from malaria during the year.

Malaria amongst natives is practically universal in so far as they carry the infection. With the exception of infants and young children and in those suffering from other disease, the ill effects are almost negligible.

Blackwater fever.—The numbers given below represent accurately the extent of this disease in Europeans.

With the exception of one case, about which there is still some doubt, blackwater fever is unknown in natives of this country.

Filariasis.—As previously stated, no case of the occurrence of this disease in a European is known.

It is impossible to give numbers in dealing with the prevalence of the disease amongst natives. They seldom or never apply for its treatment. It is occasionally met with under a variety of circumstances:—

Filaria bancroftii.—In connection with elephantiasis, and during the examination of blood specimens in concurrent diseases, or suspected diseases, such as trypanosomiasis, tick fever, malaria.

Filaria perstans is very occasionally met with under similar circumstances. Little or no comparison can be made as to its incidence in the various districts; it is comparatively rare in all. It is probably a little more prevalent in the East Luangwa District than elsewhere. Quinine as a prophylactic against malaria is universally used by the Government officials of this territory. Five grains per day are taken from the commencement of the rains (about December) to the end of May. During the remaining six months those who have been previously infected as a rule continue its use in smaller quantities, those who have not been previously infected for the most part discontinue its use. This system has been found eminently satisfactory in its results.

Amongst the general European population quinine as a prophylactic is very largely used in the method previously described. There is, however, a certain section of the community who still decline to be educated on this subject.

Natives.—Quinine prophylaxis is in use amongst certain classes of natives in Government employment, police, prisoners, &c., otherwise it is not used amongst the general native population.

ANNEXURE.

In connection with the report on mosquito-borne diseases, certain questions are asked, some of which only are applicable to this territory, or are possible to answer, as follows:—

(1) Name of Colony: Northern Rhodesia.
(2) Total area: 290,000 square miles.
(3) Estimated population:
  (*a*) Europeans, 1,900.
  (*b*) Natives, 1,000,000.
(4) Births during year:
  Europeans, 50.
(5) Deaths during year (Europeans):
  (*a*) Total deaths, 45.
  (*b*) Ascribed to malaria, 7.
  (*c*) Ascribed to blackwater, 11.
(6) Government hospitals:
  (*a*) Europeans, 3.
  (*b*) Natives, 12.

European hospital.

—	Admissions.	Malaria.	Deaths.	Blackwater.	Deaths.	Deaths from all causes.
Livingstone ...	202	89	3	19	3	9
Broken Hill	63	30	1	7	3	4
Fort Jameson	12	3	—	—	—	1

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

The following figures from four native hospitals may be taken as representative of the relative frequency throughout the territory of those diseases coming under treatment:—

—	Admissions.	Malaria.	Filaria.	Deaths from all causes.
Livingstone	177	11	—	17
Broken Hill	132	11	—	20
Ndola	117	3	—	13
Fort Jameson	91	—	—	14

(8) *Medical service:*
Number of Government Medical Officers, 18.
Number of other registered practitioners, 5.

(9) *European schools:*
Average daily attendances, 9·9.
Number of scholars registered, 18.

Native schools:
One State-aided.
A large number of native schools are under the direction of the various missionary societies. No figures are available from these.

(10) Estates employing indentured labourers, none.
Mining companies employing indentured labourers, 2.
Number of hospitals on such estates, 2.
Number of labourers employed, 400.
Total deaths among such labourers, 6.
Deaths ascribed to malaria, none.
On one of these
Total admissions to hospital, 101.
Total admissions to hospital for malaria, 7.
Total attendances, 1,252.
Total attendances for malaria, 51.
} One mine only.

(11) Estimated revenue, £127,530.

(12) Estimated expenditure, £183,575.
Upkeep of Government hospitals and dispensaries, £7,500.
Annual medical and sanitary, £19,492.
Total salaries and allowances of medical officers, £8,700.

(13) Towns under municipalities or town councils:
Number of such, 1.
Total population, European, 400.
Total population, native, 2,000.

(17) Municipal regulations are in force against the breeding of mosquito in premises.

Kala-azar is not known to exist.

About 1,000,000 grains Government quinine distributed. Annually a marked decrease in the malaria incidence amongst Europeans has been observed.

I have, &c.,
A. MAY,
Principal Medical Officer.

The Secretary,
Livingstone,
Northern Rhodesia.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

No. 9.

SOUTHERN RHODESIA.

THE HIGH COMMISSIONER FOR SOUTH AFRICA to THE SECRETARY OF STATE.

(Received 1 March, 1913.)

High Commissioner's Office, Cape Town,
February 12, 1913.

Sir,

With reference to my despatch of to-day's date,* and previous correspondence, I have the honour to forward, for your information, a copy of a despatch from the Acting Administrator of Southern Rhodesia transmitting a report on the subject of mosquito-borne diseases in that territory for the year 1911.

I have, &c.,
GLADSTONE,
High Commissioner.

Enclosure in No. 9.

Administrator's Office, Salisbury,
4th January, 1913.

My Lord,

With reference to your Lordship's despatch of 19th December, I have the honour to enclose a copy of a report by the Medical Director on the subject of mosquito-borne diseases for 1911.

I have, &c.,
F. J. Newton,
Acting Administrator.

His Excellency
The High Commissioner,
Cape Town.

Extract from Public Health Report, 1911.

Mosquito-Borne Diseases, Southern Rhodesia, 1911.

Malaria continues to rank as the most important factor in the sickness incidence of the territory: 34·11 per cent. of the total European admissions to hospitals being due to this cause alone. There were 937 admissions during 1911, of which 739 were Europeans and 198 natives. In 1910 there were 915 admissions, of which 706 were Europeans and 209 natives. It would be fairer, however, to compare the malarial incidence with the growth of the population. If we turn to the year 1907, we find that with a population of 14,007 there were 661 admissions to general hospitals on account of malaria, giving a sickness incidence rate of 44·1 per thousand of the total population. In 1911, with a population of 23,606, there were 739 admissions, or a proportion of 31·3 per thousand of the population—a marked decrease. There has been no marked increase in any one district, with the exception perhaps of Umtali, where there were 176 cases treated, as compared with 126 in 1910; the rise and fall in any one district being chiefly influenced by the numerical variations of the rural population. There is little to add this year to what has been said so often with regard to the prevalence of the disease. As before, it continues to be chiefly confined to the inhabitants of the rural districts, and becomes less and less prevalent in urban areas as years advance. It must be admitted, however, that farmers and others are slowly but surely becoming alive to its dangers, and are at last adopting precautions for its prevention. Literature relating to the cause and prevention of malaria and blackwater is still distributed by the Government to all and sundry, and the teaching of this subject continues to be compulsory in all Government schools. As I have previously had occasion to report, concerted

* No. 11.

crusades against the mosquito and its haunts are not applicable to the conditions existing in Southern Rhodesia, and the care of his health must be very largely left to the intelligence and judgment of the individual. There are vast stretches in this territory still open to occupation, whilst mines continue to open up in fresh districts, and so long as this stage of settlement and reclamation of the land continues, so long will malaria remain amongst us. For the first two or three seasons the farmer or the miner has to live under conditions which are undoubtedly prejudicial to his health; he has to bring the land under the plough, or has his mine to open up, and not till this has been done and he has shown some return for his labour can he devote his energies and his resources to erecting suitable housing accommodation, and generally safe-guarding himself and his family. Still, though much remains to be done, it is a matter of some satisfaction that malaria is year by year becoming less in our towns, and that the proportion of cases per head of the population is decreasing generally.

There were 40 cases of blackwater fever, of which 39 were Europeans and 1 native, as compared with 76 in the previous year, of which 75 were Europeans and 1 native—a decrease of 47·37 per cent. The mortality rate was also lower, being 17·95 per cent. of the cases treated, as compared with 22·66 per cent. in 1910. There were in all 19 deaths from this cause in Southern Rhodesia during the year. It is to be hoped that, as the adoption of anti-malarial precautions increases, this serious complication of malaria will gradually be eliminated from our midst.

A. M. FLEMING,
Medical Director.

No. 10.

SOUTHERN RHODESIA.

EXTRACT FROM PUBLIC HEALTH REPORT, 1912.

Mosquito-borne Diseases.

(Received in Colonial Office, 23 September, 1913.)

Referring to mosquito-borne diseases, which in this country include only malaria and blackwater, we find that in 1911 there were 25 deaths from malaria and 19 from blackwater, representing 8·68 per cent. and 6·60 per cent. of the total deaths respectively, whilst in 1912 the mortality from these causes amounted to 6·45 per cent. and 10·56 per cent. respectively. This increase in the mortality from blackwater is somewhat disquieting, and is the cause of considerable anxiety to the community, especially in certain of the outside districts where malaria and blackwater are especially prevalent. When we compare the incidence with the population we find that in 1911 ·08 per cent. of the population succumbed to the disease, as compared with ·12 per cent. in 1912. This difference, however, would undoubtedly be less apparent if we were in a position to gauge the relative increase of the rural over the urban population, the relation between the two having undoubtedly altered, and it is amongst the former that the majority of cases of malaria and blackwater occur.

Malaria.—Of the 2,283 European admissions to hospitals, 770 were on account of malaria, amongst whom there were six deaths, giving the low mortality of ·78 per cent. This, however, does not, in any way, represent the malaria incidence in the country generally, as the majority of cases, especially those occurring in rural districts, are treated in their own homes or on the veldt, and rarely in the remoter parts is a doctor even called in to attend. This is borne out by the fact that, although only six deaths have occurred in hospitals, showing that, when treated, malaria is seldom a fatal disease, still 22 deaths were registered as due to this cause in the whole of the territory during the year.

Though it cannot be said that malaria is increasing, admissions to hospitals from this cause being only in the proportion of 28·63 per thousand of the population, as compared with 31·31 per thousand in 1911, still it is an unfortunate fact

that in many of the districts little or no attempt is even now being taken to apply prophylactic measures for its prevention.

The causes of malaria have been so thoroughly ventilated in the past few years, and are now so generally known, that it might be thought measures for its prevention, which are simple and inexpensive to carry out, would have received more attention from the public than they do to-day.

The striking result attained by the enforcement of systematic anti-malarial precautions in such places as the Panama Canal zone, Ismailiah, Hong Kong, and many other places, is ample testimony of the efficiency of these measures, and the comparative health which can be enjoyed by the inhabitants who profit by these advantages.

The standpoint of the population of Southern Rhodesia is, however, different; for while in the places mentioned the individual is more or less under control either of the Government or of the municipalities, and mosquito crusades and other anti-malarial measures are organised under the supervision of sanitarians, who have at their disposal large staffs of trained officials; whilst refusal to comply with the regulations imposed on the part of individuals exposes them to dismissal from a post, or brings them within the reach of the law, in Southern Rhodesia, however, the population most exposed to infection are farmers, traders, miners, prospectors and others scattered over an enormous area, who cannot be placed under personal restrictions, and who must, therefore, be entirely left to work out their own salvation in this respect. It is obvious the farmer who has purchased his farm cannot be turned out of the country, nor is the country far enough advanced for the imposition of regulations which would govern his health in spite of himself.

Lack of funds has undoubtedly much to do with this inertia on the part of the settler, and it would seem advisable for the Government to consider some scheme for the advance of money to farmers and others to be devoted entirely to this purpose. Tropical sanitation can only be effectively carried out, and can only succeed, provided money is spent and individual effort is enforced. Though the amount to be spent in this direction may seem an enormous sum in the aggregate, still the share of the individual would be small indeed.

The Government is doing what it can in the way of continuing to educate the public into the causes of malaria, its consequences if neglected, and how it may be prevented. The subject is taught in schools, lectures are arranged for to farmers where possible, and pamphlets are distributed broadcast free of charge. What is required, however, is a popular crusade, preferably inaugurated and supported by the more intelligent section of the public; but it is hard to arouse interest in this direction.

Blackwater Fever.—There has been an increase in the number of admissions to general hospitals on account of blackwater fever; 61 admissions being reported, as compared with 40 in 1911, but a decrease on 1910, when the admissions from this cause amounted to 76. Of these 61 admissions in 1912, one case only was a native, the rest being all Europeans. The mortality rate was 28·33 per cent., being somewhat higher than the average. This complication of malaria was especially prevalent in the Mazoe, North Mazoe, and Lomagundi districts, where the population is largely an agricultural one, and has been increasing at a rapid rate during the last eighteen months or two years. Malaria and its sequelæ have always been particularly severe in this part of the country ever since the occupation; at the same time the prevalence of blackwater fever amongst the farming community this year has aroused considerable local alarm.

It might have been hoped from this that the community would be aroused to the necessity for safeguarding their health against mosquito-borne diseases, but it is a matter for regret that the idea seems to have taken root there, and is apparently gaining ground, that in blackwater fever we have a new disease about which little is known, and for which there is no present remedy. In consequence, many of the settlers have apparently accepted this as an excuse for avoidance of all efforts to eradicate mosquitoes round their dwellings, and for the adoption of a policy of inactivity on their own part—a most fatal attitude to adopt in their particular case, where individual intelligence and effort are the sum and substance of the remedy.

The increased number of cases of blackwater and malaria in these rural districts is to be ascribed to the fact that there has been a steady immigration on the land

in recent years, and that, as I reported last year, the farmer for the first two or three seasons lives under conditions which are prejudicial to his health, and it is only when he has brought his land to the producing stage that he can devote his energies and resources to erecting suitable housing accommodation, and apply the particular forms of sanitation peculiar to his tropical surroundings.

No. 11.

SWAZILAND.

The HIGH COMMISSIONER FOR SOUTH AFRICA to the SECRETARY OF STATE.

(Received 1 March, 1913.)

High Commissioner's Office, Cape Town,
February 12th, 1913.

Sir,

I have the honour to enclose, for your information, a copy of a despatch from the Resident Commissioner of Swaziland giving information with regard to mosquito-borne diseases in that territory for the year 1912.

2. The reports in respect of Southern and Northern Rhodesia for 1912 will be forwarded to you as soon as received.

I have, &c.,
GLADSTONE,
High Commissioner.

Enclosure in No. 11.

Resident Commissioner's Office, Mbabane,
January 1st, 1913.

My Lord,

With reference to Your Excellency's despatch of January 19th, 1911, on the subject of the prevention of mosquito-borne diseases, I have the honour to state that no reliable statistics can be furnished in regard to Swaziland as required by the circular despatch from the Right Honourable the Secretary of State for the Colonies dated December 20th, 1910. Very few Europeans live in the low malarial areas, and amongst the natives the disease is endemic, and, in ordinary years, takes a mild form. Births and deaths of natives are not registered in Swaziland.

2. Pamphlets and posters dealing with the cause and prevention of malaria have been distributed amongst the European population, and both European and native schools have been supplied with cards and pamphlets bearing on these subjects. A supply of quinine and other medicines is kept at each station and is issued free to natives on application; they do not, however, avail themselves of this as a rule.

I have, &c.,
R. T. Coryndon,
Resident Commissioner.

His Excellency
The Right Honourable,
Viscount Gladstone, P.C., G.C.M.G.,
High Commissioner for South Africa.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

No. 12.

CAYMAN ISLANDS.

RETURN OF MALARIA FEVER, BLACKWATER FEVER, YELLOW FEVER AND FILARIASIS FROM JANUARY 1 TO DECEMBER 31, 1912.

(Received in Colonial Office, 21 October, 1913.)

1. Name of colony :—Cayman Islands.
2. Total area :—61,000 acres.
3. Population at time of census, April, 1911 (no later figures available) :—Total 5,564.
   Europeans, 20.
   Other races, 5,544.
   White, 2,322.
   Coloured, 2,211.
   Black, 1,031.
4. Births during the year :—228.
5. Deaths during the year :—58. None ascribed to malaria, blackwater or yellow fever.
6. Government hospitals :—None.
7. Government dispensaries :—None.
8. Number of Government Medical Officers :—2. No special Health Officers or other registered practitioners.
9. Number of (*a*) Government Schools :—4.
   ,, ,, State-aided Schools :—None.
   (*b*) Scholars registered in these schools :—377.
   (*c*) Percentage of daily attendance :—75 per cent.
10. Estates employing indentured labour :—None.
11. Estimated revenue of colony :—£2,990.
12. Estimated expenditure :—
    (*a*) Total during year, £2,779.
    (*b*) Annual medical and sanitary expenditure, £250.
    (*c*) Upkeep of Government hospitals and dispensaries, nil.
    (*d*) Total salaries and allowances of Medical Officers, £310.
    (*e*) Total annual sanitary expenditure, nil.
13. Towns under Municipalities or Town Councils :—None.

District.	Area.	Population at time of Census, April, 1911.	Total Deaths.			
			Quarter ending March 31st, 1912.	Quarter ending June 30th, 1912.	Quarter ending September 30th, 1912.	Quarter ending December 31st 1912.
Georgetown and West Bay	—	2,411	5	4	6	4
Prospect and S.W. Sound ...	—	346	Nil	Nil	3	1
Boddentown	—	625	2	1	3	1
East End and Northside ...	—	746	Nil	1	2	4
Lesser Caymans	—	1,436	8	7	2	4
Total	—	5,564	15	13	16	14

Rainfall during the Year 1912.

District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Georgetown	1·50	1·75	3·71	1·25	2·97	7·74	4·74	11·14	13·74	13·10	7·92	·58
Boddentown	·68	1·06	·76	·91	2·09	3·93	1·72	3·47	2·60	7·89	5·06	·29
East End	1·35	1·12	1·23	1·26	2·75	4·82	Nil	4·48	5·50	10·82	5·53	3·35

17. (For questions see page 6.)—(*a*) No.
(*b*) None.
(*c*) None.
(*d*) One large marsh has been drained at a cost of about £10, but this has not produced the results anticipated, since the marsh is below the level of the sea, and to drain the swamp area effectively would entail a large expenditure of money.
(*e*) None.
(*f*) None.
(*g*) No.
(*h*) No estates employing indentured labour.
(*i*) There are no poor requiring housing.
(*j*) No.
(*k*) Malarial fever is not epidemic in the Cayman Islands; the few cases coming under observation are imported from the Panama Canal and other Central American districts. These cases, as a rule, recover completely in a few weeks. In cases where the anæmia is very pronounced recovery takes place in about two months. Cases of imported malarial fever receive treatment from time to time.

No. 13.

JAMAICA.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1ST JANUARY TO THE 31ST DECEMBER, 1912.

(Received in Colonial Office, 21 October, 1913.)

1. Name of colony :—Jamaica.
2. Total area :—4,450¼ square miles.
3. Estimated (mean) population (*i.e.*, on 30 September, 1913).—

(*a*) Total, 850,813.

At date of census 1911, when population was, 831,383.

(*b*) Europeans (*i.e.*, persons born in Europe) ...	2,909
(*c*) Other races	828,474
	831,383

Census of 1911 showed :—

White	15,605
Coloured	163,201
Black	630,181
East Indian	17,380
Chinese	2,111
Not specified	2,905
	831,383

4. Births during the year :—

Total births, 33,976.

5. Deaths during the year :—

(*a*) Total deaths, 20,284.
(*b*) Deaths ascribed to fever, 3,000.
(*c*) Deaths ascribed to blackwater fever, none.
(*d*) Deaths ascribed to yellow fever, none.

Appendix I.

6. Government Hospitals :—
   (*a*) Number of such hospitals, 21.*
   (*b*) Totals during year :—

Admissions	27,017
Deaths	491

   (*c*) Malarial fever :—

Admissions	8,586
Deaths	80

   (*d*) Blackwater fever :—

Admissions	5
Deaths	Nil.

   (*e*) Yellow fever :—

Admissions	Nil.
Deaths	Nil.

   (*f*) Filarial diseases :—

Admissions	3
Deaths	Nil.

   (*g*) Dengue :—

Admissions	Nil.
Deaths	Nil.

7. Government dispensaries :—
   There are out-patients' departments at the various hospitals.
   (*a*) Number of such dispensaries, none.
   (*b*) Total attendance at out-patients' department of hospitals during year 1912-13, 20,477.
   (*c*) Attendance for malaria, unknown.
   (*d*) Attendance for filarial disease, unknown.
   (*e*) Attendance for dengue, unknown.

8. Medical Service :—
   (*a*) Number of Government Medical Officers, 52.
   (*b*) Number of special Health Officers, 26.†
   (*c*) Number of other registered practitioners, 77.

9. Schools :—
   (*a*) Number of Government and State-aided schools, 698.
   (*b*) Number of scholars registered in these schools, 98,576.
   (*c*) Percentage of daily attendances, 62·55.

10. Estates employing indentured labour :—
   (*a*) Number of such, 77.
   (*b*) Number of indentured labourers employed, 3,631.
   (*c*) Number of hospitals and dispensaries on such estates, nil.‡
   (*d*) Total deaths among such labourers, 68.
   (*e*) Deaths ascribed to malaria, 8.
   (*f*) Total admissions and attendances at hospitals and dispensaries, 25,533.

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* One of which is a Lying-in Hospital, and one a Cottage Hospital not yet opened for admission of patients.

† These are officers paid by the Parochial Board; all being part time officers except one; only one of them holds a qualification in Public Health.

‡ There are 11 Public General Hospitals and 3 Dispensaries at which indentured immigrants are treated.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

11. Approximate revenue of colony :—

	£ s. d.	£ s. d.
Total during financial year ended 31st March, 1913 (including Parochial revenue and revenue of Kingston General Commissioners)		1,436,713 9 2
General revenue	1,205,808 9 1¾	
Parochial revenue	194,922 10 8¼	
Revenue of Kingston General Commissioners	35,982 9 4	
	£1,436,713 9 2	

12. Approximate expenditure of colony :—

	£ s. d.	£ s. d.
(*a*) Total during financial year ended 31st March, 1913 (including Parochial expenditure and expenditure of Kingston General Commissioners)		1,554,756 15 2
Expenditure from—		
General revenue	1,321,285 2 8	
Parochial revenue	196,712 0 8	
Revenue of Kingston General Commissioners	36,759 11 10	
	£1,554,756 15 2	

	£ s. d.	
(*b*) Annual medical and sanitary expenditure, 1912-13—		
Medical department	74,428 5 1	
*Expenditure by Malaria Commission	9,266 6 10	
Parochial expenditure ...	98,691 16 9	
Expenditure by Kingston General Commissioners ...	9,870 0 0	
		192,256 8 8
(*c*) Upkeep of Government hospitals and dispensaries, 1912-13 ...		50,135 15 7
(*d*) Total salaries and allowances of Medical Officers, 1912-13 ...		9,943 19 1†
(*e*) Total annual sanitary expenditure, 1912-13—		
Malaria Commission	9,266 6 10	
Parochial	98,534 13 9	
*Kingston General Commissioners	9,870 0 0	
		117,671 0 7

13. Towns under Municipalities or Towns Councils :—

(*a*) Number of such, 23.

* Includes debt charges £6,543 17s. 11d.

† Of this sum £3,640 18s. 3d. is also included in the reply to question 12 (*c*).

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

(*b*) Population :—

Kingston (estimated mean)		...	60,362	
Half-Way-Tree (At time of Census 1911)	...	...	23,322	(Half-Way-Tree and vicinity.)
Morant Bay	,,	,,	1,984	
Port Morant	,,	,,	—	(not stated.)
Port Antonio	,,	,,	7,074	
Buff Bay	,,	,,	—	,, ,,
Annotto Bay	,,	,,	—	,, ,,
Richmond	,,	,,	—	,, ,,
Port Maria	,,	,,	2,833	
St. Ann's Bay	,,	,,	2,592	
Brown's Town	,,	,,	—	,, ,,
Falmouth	,,	,,	2,288	
Montego Bay	,,	,,	6,616	
Lucea	,,	,,	1,447	
Green Island	,,	,,	—	,, ,,
Sav-la-Mar	,,	,,	3,400	
Black River	,,	,,	1,262	
Mandeville	,,	,,	1,198	
Chapelton	,,	,,	636	
May Pen	,,	,,	—	,, ,,
Linstead	,,	,,	—	,, ,,
Spanish Town	,,	,,	7,119	
Old Harbour	,,	,,	—	,, ,,

(*c*) Total revenue 1912-13, Kingston (other towns have no independent revenues)—

	£	s.	d.
Mayor and Council	44,009	10	0
Kingston General Commissioners ...	39,308	11	5

(*d*) Total medical and sanitary expenditure, 1912-13, Kingston (other towns have no independent expenditure)—

	£	s.	d.
Mayor and Council	5,182	12	10
Kingston General Commissioners (Sewage)	3,326	2	1
Kingston General Commissioners Debt Charges	6,543	17	11

14. Table of Deaths by Parishes.

Parish.	Area. Square Miles.	Estimated Population (mean).	Total Deaths.				
			March Quarter.	June Quarter.	September Quarter.	December Quarter.	Year.
Kingston	$7\frac{3}{4}$	60,362	425	441	404	509	1,779
St. Andrew	183	53,380	411	387	326	424	1,548
St. Thomas	$298\frac{1}{2}$	40,122	236	235	236	255	962
Portland	338	50,494	321	268	353	451	1,393
St. Mary	251	74,812	455	395	346	369	1,565
St. Ann	487	72,773	359	284	299	337	1,279
Trelawny	353	36,118	245	178	198	194	815
St. James	$239\frac{1}{2}$	42,264	249	234	307	288	1,078
Hanover	177	38,329	210	232	215	267	924
Westmoreland ...	320	67,888	368	313	470	452	1,603
St. Elizabeth ...	$473\frac{1}{2}$	81,004	418	356	509	644	1,927
Manchester	337	67,220	252	265	388	384	1,289
Clarendon	487	75,927	452	385	418	467	1,722
St. Catherine ...	498	90,120	608	569	519	704	2,400
Total	$4,450\frac{1}{4}$	850,813	5,009	4,542	4,988	5,745	20,284

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

15. Table of Deaths in the Principal Towns.

Town.	Estimated Population. (Mean.)	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Kingston ...	58,047	145	143	132	152	156	124	152	112	138	138	161	206	1759

(No figures available for other towns.)

16. Rainfall during the Year.

Where observed.	District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
		ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
At about ·150 "average" stations.	North East.	7·64	4·38	4·00	3·64	3·76	3·12	3·64	6·84	5·83	9·76	41·21	7·56	101·38
	North...	4·22	2·16	3·45	1·14	2·86	1·86	3·41	4·22	3·71	6·70	27·30	3·23	64·26
	West Central.	3·39	1·83	7·61	2·71	9·49	3·68	7·72	10·58	10·93	10·68	22·82	1·85	93·29
	South...	2·35	1·26	4·44	1·36	2·29	1·06	2·44	3·68	4·44	5·85	15·63	1·35	46·15
...	The Island.	4·40	2·34	4·88	2·21	4·60	2·43	4·30	6·38	6·23	8·25	26·74	3·50	76·26

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—Yes, Section 7 of Law 35 of 1910. Bye Laws have been framed under Section 11 of Law 35 of 1910.

Number of notices, convictions and warnings during the year.—Notices and warnings 18,741, convictions 97. (In the parish of Manchester several hundred notices and warnings were issued; no record of the number was kept.)

(*b*) Number of children examined for enlarged spleen.—No examination made. Does kala-azar exist?—No.

(*c*) Number of persons examined for filarial diseases.—No examination made.

(*d*) Any large works for surface drainage of towns or reclamation of marshes.—

Kingston.—Reclamation of swamp land, Kingston Pen. Concrete drains in Kingston, especially Salt Lane. Verley Swamp—reclamation. Concrete gutters, Windward Road.

St. Andrew.—Absorption pits, Half-Way-Tree.

St. Thomas.—Brown's Gully—improvement of condition of. Port Morant Swamp—filling, &c. Bamboo Pool—improvement of condition of. Concrete gutters in towns.

Portland.—Quacco Gully. Concrete drains in towns. East Town River Canal and Outlet, &c. New hospital site. Hope Bay—sanitary works at.

St. Mary.—Warner's Pond—reclamation, &c. Pencar River. Concrete drains in towns.

St. Ann.—Reclamation of swamp land. Reconstruction of streets.

Trelawny.—Construction of sea wall, Falmouth. Swamp land at quarry, Falmouth—reclamation.

Hanover.—Riley's corner—improvement of sanitary condition.

Westmoreland.—Concrete drains in Sav-la-Mar.

St. Elizabeth.—Dickenson's Swamp—draining and filling. Improvements to beds of Elim River, Grosmond River, Smith's River, Thatch River, and Black River, with a view to draining adjoining swamps. Thornton Swamp—drainage.

St. Catherine.—Concrete drains in towns of Spanish Town, Old Harbour and Linstead.

Approximate cost—£12,113 14s. 4d.

(*e*) Number of men employed in towns and villages for petty anti-mosquito works.—As a rule no men are employed by Parochial Boards exclusively

for petty anti-mosquito works, but in each parish of the Island the Parochial Inspectors of Nuisances attend to such work, and in many instances these men have received special instructions in the subject.

(*f*) Amount of Government quinine sold or distributed gratis during the year. —In tablets 8,402 ounces, in powder 3,020 ounces, total 11,422 ounces.
Agencies employed.—Public Hospitals, Parochial Boards, Malaria Commission, Post Offices, Police, Estates (Managers).

(*g*) Is quinine distributed regularly in the schools?—Yes.

(*h*) Measures taken against these diseases on estates employing indentured labour.—Employers are requested to supply quinine to indentured immigrants regularly (twice weekly) and to keep the barracks where their labourers live and the surroundings in a sanitary condition.

(*i*) Any steps taken regarding the housing of the poor.—There are poor houses in most of the parishes, which are under parochial administration.

(*j*) Any exceptional increase or decrease of these diseases recently noticed.—No.

(*k*) Any other remarks on the subject.—No.

Statistics regarding Malaria amongst the Troops serving in Jamaica during the year 1912.

Average Strength.	Deaths from all Diseases.	Deaths from Malaria.	Remarks.
European Troops.			
375	2	—	
Non-European Troops.			
543	1	—	

Number of cases of Malaria and ratio per 1,000 by Stations.

Up Park Camp.		Port Royal.		Newcastle.	
Number of Cases.	Ratio per 1,000.	Number of Cases.	Ratio per 1,000.	Number of Cases.	Ratio per 1,000.
European Troops.					
5	55·55	8	37·03	—	—
Non-European Troops.					
11	20·26	—	—	—	—

Statistics regarding Malaria amongst the Troops serving in Jamaica during the years 1911 and 1912

1911.			1912.		
Strength.	Number of Admissions.	Average Number constantly sick. Per cent.	Strength.	Number of Admissions.	Average Number constantly sick. Per cent.
European Troops.					
389	31	·53	375	13	·24
Non-European Troops.					
659	82	·31	543	11	·02

APPENDIX I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

No. 14.

LEEWARD ISLANDS.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS AND DENGUE DURING THE YEAR FROM THE 1st JANUARY TO THE 31st DECEMBER, 1912.

(Received in Colonial Office, 2 September, 1913.)

ST. KITTS-NEVIS.

1. Colony of the Leeward Islands (Presidency of St. Kitts-Nevis).
2. Total area :—St. Kitts, 65 square miles; Nevis, 50 square miles; Anguilla, 35 square miles; total, 150 square miles.
3. Estimated population :—
   (a) Total, 43,303.
   (b) Whites, 1,582.
   (c) Other races, 41,721.
4. Births during the year, 1,676.
5. Deaths during the year :—
   (a) Total deaths, 1,268.
   (b) Deaths ascribed to fever, 23.
   (c) Deaths ascribed to blackwater fever, none.
   (d) Deaths ascribed to yellow fever, none.
6. Government hospitals :—
   (a) Number of hospitals, two.
   (b) Totals during the year :—

Admissions	836
Deaths	116

   (c) Malarial fever :—

Admissions	16
Deaths	Nil.

   (d) Blackwater fever :—

Admissions	Nil.
Deaths	Nil.

   (e) Yellow fever :—

Admissions	Nil.
Deaths	Nil.

   (f) Filarial Diseases :—

Admissions	51
Deaths	3

   (g) Dengue :—

Admissions	Nil.
Deaths	Nil.

7. Government dispensaries :—
   (a) Number of such dispensaries, 6.
   (b) Total attendances during the year, unknown.
   (c) Attendances for malaria, unknown.
   (d) Attendances for filarial diseases, unknown.
   (e) Attendances for dengue, none.
8. Medical service :—
   (a) Number of Government medical officers, 9.
   (b) Number of special health officers, none.
   (c) Number of other registered practitioners, none.
9. Schools :—
   (a) Number of Government and State-aided schools, 52.
   (b) Number of scholars registered in these schools, about 9,000.
   (c) Percentage of daily attendances, 50 per cent.
10. Estates employing indentured labour, none.
11. Estimated revenue of the Presidency, £57,288.
12. Estimated expenditure of the Presidency, £53,508.
   (b) Annual medical and sanitary expenditure, £5,117.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

(*c*) Upkeep Government hospitals and dispensaries, £7,204.
(*d*) Total salaries and allowances of medical officers, £2,322.
(*e*) Total annual sanitary expenditure, £2,794.

13. Towns under municipalities or town councils :—
(*a*) Number of such, one.
(*b*) Total population, 8,159.
(*c*) Total revenues, Government grant, £2,477.
(*d*) Total medical and sanitary expenditure, £5,629.

14. TABLE OF DEATHS BY DISTRICTS.

District.	Area sq. miles.	Population.	Total Deaths.												
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
St. Kitts ...	65	26,406	74	70	74	57	61	73	65	56	61	73	67	85	816
Nevis ...	50	13,103	29	30	36	21	21	21	20	25	20	25	49	77	374
Anguilla ...	35	4,202	8	4	7	3	7	5	8	8	6	8	5	7	76
Total ...	—	—	111	104	117	81	89	99	93	89	87	106	121	169	1,266

15. TABLE OF DEATHS IN THE PRINCIPAL TOWNS.

Town.	District.	Population.	Total Deaths.												
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Basseterre ...	St. Kitts	8,159	36	29	32	25	25	32	29	23	29	29	31	32	352
Charlestown	Nevis ...	912	7	6	6	4	7	2	3	5	4	4	3	7	58
Total ...	—	—	43	35	38	29	32	34	32	28	33	33	34	39	410

16. RAINFALL DURING THE YEAR.

Where observed.	District.	Rainfall.												
		Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Botanic Station Basseterre ...	St. Kitts	2·69	1·40	1·15	3·01	1·06	2·86	2·59	2·19	7·61	7·13	8·80	2·40	42·89
„ Charlestown	Nevis ...	3·84	·68	2·66	4·20	·79	2·51	3·56	3·46	3·19	5·25	6·43	2·85	39·42
Wall Blake	Anguilla	1·71	1·21	1·36	1·85	·32	1·55	1·17	1·62	2·39	7·59	4·51	2·18	27·46

17. Additional information to be given if possible on the following points.
(*a*) Is there any legislation in force against the breeding of mosquitos in premises?—Yes.
Number of notices, convictions, and warnings during the year: Numerous, but no exact record at present kept.
(*b*) Number of children examined for enlarged spleen, none. Does Kala-azar exist?—No.
(*c*) Number persons examined for filarial diseases.—Not done systematically.
(*d*) Any large works for surface drainage of towns or reclamation of marshes?—Annual work. Approximate cost, £100 per annum.
(*e*) Numbers of men employed in towns or villages for petty anti-mosquito works, 10. Approximate cost, £140.
(*g*) Is quinine distributed regularly in the schools?—No.
(*k*) Any other remarks on the subject.—Malaria not being endemic in the island, a regular distribution of quinine is not enforced.

W. H. FRETZ,
Senior Medical Officer.

St. Kitts,
16th July, 1913.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

Dominica.

1. Name of Colony, Presidency of Dominica.
2. Total area, 304⅝ square miles.
3. Estimated population :—
   (a) Total, 34,853.
   (b) European, 399.
4. Births during the year :—
   Total births, 1,336.
5. Deaths during the year :—
   (a) Total deaths, 780.
   (b) Deaths ascribed to fever, unknown.
   (c) Deaths ascribed to blackwater fever, unknown.
   (d) Deaths ascribed to yellow fever, unknown.
6. Government hospitals :—
   (a) Number of such hospitals, two.
   (b) Totals during year :—

Admissions	863
Deaths	83

   (c) Malarial fever :—

Admissions	71
Deaths	9

   (d) Blackwater fever :—

Admissions	Nil.
Deaths	Nil.

   (e) Yellow fever :—

Admissions	Nil.
Deaths	Nil.

   (f) Filarial diseases :—

Admissions	4
Deaths	Nil.

   (g) Dengue :—

Admissions	Nil.
Deaths	Nil.

7. Government dispensaries :—
   (a) Number of such dispensaries, 17.
   (b) Total attendances during year, 10,753.
   (c) Attendances for malaria, 1,383.
   (d) Attendances for filarial diseases, 12.
   (e) Attendances for dengue, none.
8. Medical service :—
   (a) Number of Government medical officers, 5.
   (b) Number of special health officers, 3.
   (c) Number of other registered practitioners, 1.
9. Schools :—
   (a) Number of Government and State-aided schools, 26.
   (b) Number of scholars registered in these schools, 5,510.
   (c) Percentage of daily attendances, 39·3 per cent.
10. Estates employing indentured labour :—
   (a) Number of such.
   (b) Number of indentured labourers employed.
   (c) Number of hospitals and dispensaries on such estates.
   (d) Total deaths among such labourers.
   (e) Deaths ascribed to malaria.
   (f) Total admissions and attendances at hospitals and dispensaries.
   } Nil.
11. Estimated revenue of Presidency :—
   Total during year, £40,655.

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

12. Estimated expenditure of Presidency :—
    (*a*) Total during year, £40,263.
    (*b*) Annual medical and sanitary expenditure, £772.
    (*c*) Upkeep of Government hospitals and dispensaries, £2,486.
    (*d*) Total salaries and allowances of medical officers, £1,559.
    (*e*) Total annual sanitary expenditure, £347.
13. Towns under municipalities or town councils :—
    (*a*) Number of such, 1.
    (*b*) Total population, 6,577.
    (*c*) Total revenues, £1,374.
    (*d*) Total medical and sanitary expenditure, £383 5*s.* 3*d.*
14. Table of deaths by districts :—

District.	Area.	Population.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
E.	101$\frac{1}{6}$	15,957	29	36	36	28	28	32	29	34	16	26	32	52	378
F.	73	9,775	26	19	16	10	5	12	12	12	8	17	14	22	173
G.	129$\frac{5}{6}$	9,121	33	14	18	21	18	25	15	14	19	13	17	22	229
Total ...	...	... ...	88	69	70	59	51	69	56	60	43	56	63	96	780

15. Table of deaths in the principal towns :—

Town.	District where situated.	Population of Town.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Roseau ...	E	6,621	18	17	19	12	12	15	15	16	8	14	23	32	201
Portsmouth	G	1,023	10	1	5	5	3	8	3	2	8	3	4	5	57
Total ...	—	7,644	28	18	24	17	15	23	18	18	16	17	27	37	258

16. Rainfall during the year :—

Station.	January	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Antrim Valley	14·85	2·28	7·24	5·70	3·79	10·84	9·44	12·34	9·62	11·50	15·58	11·21	114·40
Batalie	3·93	1·09	3·45	1·18	0·36	4·52	4·88	4·53	0·24	5·40	5·10	3·49	38·17
Bellevue	15·26	4·77	8·56	11·05	5·87	11·38	8·65	10·13	10·92	16·08	21·75	14·05	138·47
Blenheim	8·37	2·16	5·98	8·59	3·31	9·85	6·48	5·16	5·84	16·66	12·93	4·50	89·83
Botanic Gardens	8·24	1·32	4·66	3·38	1·56	5·44	5·83	4·88	3·32	7·26	11·20	6·66	63·75
Canefield	9·10	·63	4·61	2·84	1·87	7·38	6·28	6·63	3·90	6·89	9·55	6·52	66·20
Castleacre	16·49	2·20	8·43	5·20	4·00	11·09	7·75	11·30	7·07	10·67	15·52	10·18	109·90
Castle Bruce	6·48	2·01	5·61	7·01	4·05	6·52	4·79	4·72	9·71	12·89	17·22	7·72	88·73
Concord	10·42	4·30	8·38	16·09	6·85	6·86	7·61	8·64	9·28	19·30	24·18	6·60	128·51
Corlet	17·76	6·60	12·10	12·60	8·95	14·55	10·55	13·25	10·44	18·14	24·24	16·61	165·79
Everton	11·53	2·95	5·14	5·12	2·71	7·79	5·57	7·89	5·50	15·26	13·98	5·54	88·98
Gleau Manioc	22·01	8·29	16·99	22·31	12·79	18·74	15·62	12·86	22·71	18·13	11·68	17·88	200·01
Goodwill	8·46	·83	4·95	2·77	1·64	4·76	5·66	4·52	3·78	5·88	10·54	6·93	60·72
Governor	10·54	3·67	5·98	13·54	6·48	9·40	6·10	8·53	11·93	17·70	13·19	7·01	114·07
Hampstead	6·28	1·75	4·18	5·75	2·17	9·28	5·74	4·40	6·04	16·96	12·06	3·65	78·26
Hatton Garden	5·11	2·15	3·70	9·05	3·75	5·64	3·70	4·81	7·43	11·36	15·05	6·30	78·05
Hillsborough	7·52	1·14	5·28	2·87	2·84	7·42	7·85	5·73	5·59	6·58	6·18	5·74	64·74
Kinellan	15·16	3·29	7·20	7·22	6·97	10·86	10·47	11·77	9·21	15·85	15·88	14·12	128·00
La Haut	13·76	3·18	5·80	6·35	3·10	7·48	6·32	6·22	5·06	14·33	10·24	7·64	89·48
Lisdara	15·12	6·08	8·78	11·91	7·47	12·06	9·29	11·78	12·25	19·45	19·62	12·57	146·38
Londonderry	5·52	2·93	3·91	6·89	3·07	7·96	4·14	3·80	8·34	11·41	11·54	4·25	73·76
Long Ditton	9·78	1·28	8·75	12·34	6·26	11·89	10·28	10·78	5·70	12·76	7·59	15·77	113·18
Macoucherie	8·01	—	1·77	·88	1·65	—	6·13	5·87	6·93	4·31	10·44	5·55	—
Melville Hall	6·80	3·60	4·36	8·25	3·55	7·74	3·95	3·89	7·70	11·75	12·65	5·16	79·40

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Station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Moore Park	8·19	1·85	3·92	8·65	1·44	8·66	5·76	5·04	4·87	10·67	11·45	6·24	76·74
Morne Bruce	9·83	1·30	5·13	3·78	1·31	5·63	6·32	5·51	3·51	8·03	11·60	7·91	69·86
Picard	5·81	2·15	3·84	4·27	4·39	9·26	5·69	9·46	5·62	6·70	8·38	9·49	75·06
Pointe Mulatre...	9·63	1·40	3·09	10·15	3·40	5·46	2·93	7·77	7·73	8·51	18·08	12·24	90·39
Rosalie	9·56	2·77	4·93	11·48	4·33	9·43	5·49	6·35	9·93	13·95	22·50	8·00	108·72
Saltoun	20·37	5·68	11·90	13·86	12·77	19·81	15·17	18·09	5·56	19·05	22·75	13·48	178·49
Shawford	20·21	1·01	11·95	9·50	6·05	15·38	11·78	14·75	11·36	13·34	18·27	16·71	150·31
Snug Corner	8·66	—	—	8·62	—	21·14	7·45	9·01	7·66	19·44	14·94	10·50	—
Soufrière	10·04	1·59	4·11	5·62	2·36	7·49	4·88	5·57	4·22	13·00	9·25	3·46	71·59
St. Aroment	11·92	1·38	5·16	4·34	·97	6·83	5·86	7·06	4·99	8·52	12·35	10·18	79·56
Wall House	9·45	3·15	4·05	3·60	1·58	5·15	7·11	3·70	3·10	12·35	10·54	5·18	68·96
Woodford Hill	6·19	2·54	4·37	5·95	2·24	7·66	4·22	4·64	7·14	10·74	13·76	6·38	75·83

Mean Rainfall, 34 Stations, 98·94 inches.
„ „ 12 Leeward Coast Stations, 69·75 inches.
„ „ 3 Windward „ „ 95·94 „
„ „ 13 Inland Stations, 135·71 „
„ „ 6 La Soye Coast Stations, 79·19 „

17. Additional information to be given if possible on the following points :—
 (*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—Roseau Town Board Regulations.
 (*b*) Number of children examined for enlarged spleen.—About 500. Where was this done?—Different dispensaries. Percentage affected.—20 per cent. Does kala-azar exist?—One case at La Plaine.
 (*c*) Number of persons examined for filarial diseases.—10. Where this was done?—Grand Bay. Percentage affected.—Unknown.
 (*f*) Amount of Government quinine sold or distributed gratis during the year.—6 lbs. and 8,356 grains. Agencies employed.—Police in 11 districts.
 (*g*) Is quinine distributed regularly in the schools?—No.
 (*i*) Any steps taken regarding the housing of the poor.—No.
 (*k*) Any other remarks on the subject.—No.

Montserrat.

Following heading in draft return :—

1. Montserrat.
2. $32\frac{1}{2}$ square miles.
3. Population (1911) :—
 (*a*) Total, 12,196.
 (*b*) European, 140.
 (*d*) Black and coloured, 12,056.
4. Births, 416.
5. Deaths, 176.

None caused by malarial fever, yellow fever, blackwater fever or dengue.

6. Government hospitals :—
 (*a*) One.
 (*b*) Admissions, 56. Deaths, 6.
 (*c*)—(*g*) No admissions for malaria, filariasis, blackwater fever, yellow fever or dengue.
7. Government dispensaries :—
 (*a*) Four.
 (*b*) Number of non-paying patients, 2,581. Number of attendances not ascertainable.
 (*c*) Attendances for malaria, none.
 (*d*) Attendances for filariasis, 16.
 (*e*) Attendances for dengue, none.

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8. Medical service :—
  (*a*) Two Government medical officers.
  (*b*) One of these is also health officer.
  (*c*) No other registered practitioners.

9. Schools :—
  (*a*) State-aided schools, 13. No Government schools.
  (*b*) Number of scholars, 3,170.
  (*c*) Percentage of daily attendances, 50 per cent.

10. No estates employing indentured labour.

11. Revenue of Presidency, 1911-12, £12,945.

12. Expenditure of Presidency, 1911-12, £10,030.
  (*b*) Annual medical and sanitary expenditure, £854.
  (*c*) Upkeep of Government hospitals and dispensaries, £89.
  (*d*) Total salaries and allowances of medical officers, £633.
  (*e*) Annual sanitary expenditure, £117.

13. No towns under municipal or town councils.

14. Table of deaths by districts :—

Parishes of	St, Anthony.	St. Patrick.	St. Peter.	St. George.	Total.
Population.	4,573.*	819.	3,545.	3,259.	12,196.
January	7	1	0	2	10
February	7	1	4	1	13
March	5	1	2	4	12
April	4	1	5	5	15
May	8	0	5	0	13
June	6	1	2	3	12
July	6	1	1	3	11
August	11	1	10	3	25
September	7	1	0	4	12
October	4	2	2	5	13
November	15	2	1	4	22
December	11	1	2	4	18
Total deaths	91	13	34	38	176

* Including principal town.

15. Table of deaths in principal town :—
  Town, Plymouth.
  District where situated, St. Anthony's.
  Population, 1,534 in 1911.

	Deaths.
January	2
February	4
March	3
April	3
May	3
June	3
July	4
August	6
September	1
October	0
November	8
December	4
Total	41

16. Rainfall:—

Where observed, Richmond.
District, St. Anthony's.

	Inches.
January	5·79
February	0·91
March	3·75
April	3·99
May	2·18
June	3·13
July	3·54
August	2·80
September	2·77
October	4·06
November	7·69
December	5·71
Total	46·32

Average for the island, 41·33 inches.

17.—(*a*) No anti-mosquito regulations yet in force.

(*b*) No systematic examination for enlarged spleens in children; no kala-azar.

(*c*) No systematic examination made for filaria.

(*d*) No works for surface drainage, beyond the town gutters and field drains on estates. One swamp in the island not drained.

(*e*) No men employed for anti-mosquito work.

(*f*) No quinine sold or distributed.

(*i*) In certain cases the poor are boarded out at public expense.

(*j*) No increase or decrease of above diseases.

(*k*) Of these diseases, filariasis only is known in the island, and that disease is comparatively infrequent.

J. C. McPHERSON,
Senior Medical Officer.

February 1st, 1913.

ANTIGUA.

1. Name of Colony, Antigua, Leeward Islands.

2. Total area, 108 square miles.

3. Estimated population:
   (*a*) Total, 31,621.

4. Births during the year:—
   Total births, 1,111.

5. Deaths during the year:—
   (*a*) Total deaths, 1,159.
   (*b*) Deaths ascribed to fever, 14.
   (*c*) Deaths ascribed to blackwater fever, none.
   (*d*) Deaths ascribed to yellow fever, none.

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6. Government hospitals :—

(a) Number of such hospitals, 1.

(b) Totals during year :—

Admissions	969
Deaths	187

(c) Malarial fever :—

Admissions	35
Deaths	3

(d) Blackwater fever :—

Admissions	Nil.
Deaths	Nil.

(e) Yellow fever :—

Admissions	Nil.
Deaths	Nil.

(f) Filarial diseases :—

Admissions	9
Deaths	1

(g) Dengue :—

Admissions	Nil.
Deaths	Nil.

7. Government dispensaries :—

(a) Number of such dispensaries.
(b) Total attendances during year.
(c) Attendances for malaria.
(d) Attendances for filarial diseases.
(e) Attendances for dengue.

Nil.

8. Medical service :—

(a) Number of Government medical officers, 6.
(b) Number of special health officers, none.
(c) Number of other registered practitioners, 2.

9. Schools :—

(a) Number of Government and State-aided schools, 34.
(b) Number of scholars registered in these schools, 7,547.
(c) Percentage of daily attendances, 3,748 = 49·6 per cent.

10. Estates employing indentured labour :—

(a) Number of such.
(b) Number of indentured labourers employed.
(c) Number of hospitals and dispensaries on such estates.
(d) Total deaths among such labourers.
(e) Deaths ascribed to malaria.
(f) Total admissions and attendances at hospitals and dispensaries.

Nil.

11. Estimated revenue of Colony, 1912-13 :—
Total during year, £53,113.

12. Estimated expenditure of Colony :—

(a) Total during year, £51,828.
(b) Annual medical and sanitary expenditure, £1,519.
(c) Upkeep of Government hospitals and dispensaries, £4,730.
(d) Total salaries and allowances of medical officers, £1,934.
(e) Total annual sanitary expenditure, £1,251.

13. Towns under municipalities or town councils :—

(a) Number of such, 1.
(b) Total population, 7,910.
(c) Total revenues, £1,991.

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14. Table of deaths by districts :—

District.	Area.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
St. John...	—	14,175	53	44	47	51	21	38	37	45	46	82	101	108	663
St. Mary...	—	4,275	—	—	20	—	—	19	—	—	13	—	—	51	103
St. Paul ...	—	4,317	—	—	15	—	—	10	—	—	18	—	—	70	113
St. Philip	—	2,972	—	—	15	—	—	7	—	—	17	—	—	51	90
St. Peter...	—	2,827	—	—	18	—	—	8	—	—	5	—	—	47	88
St. George	—	2,827	—	—	22	—	—	10	—	—	17	—	—	42	91
Total ...		31,322	53	44	137	51	21	92	37	45	116	82	101	369	1,148

15. Table of deaths in the principal towns :—

Town.	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
St. John's	—	—	53	44	47	51	21	28	37	45	46	82	101	108	
Total ...	...	...	53	44	47	51	21	28	37	45	46	82	101	108	

16. Rainfall during the year :—

Where observed.	District.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
St. John ...	St. John ...	2·64	0·94	2·81	2·50	2·01	0·86	3 53	1·49	4·70	5·02	7·50	3·17	37·17
Blake's ...	St. Paul ...	2·78	0 54	2·43	3·11	1·53	1·02	3·20	1·19	4·50	4·50	5·15	2·53	26·98
Long Lane ...	St. Philip ...	2·28	0·29	1·60	1·87	0·53	0·67	2·86	1·08	4·70	4·70	5·89	2·39	28·26
Parham N. Dock	St. Peter ...	2·91	0·86	1·81	2·30	0·89	1·11	3·45	1·01	5·72	6·07	6·07	2·48	34·68
Miller's ...	St. George ...	2·27	0·43	1·52	1·26	0·82	0·60	2·37	2·02	5·43	5·13	5·13	2·25	29·23
Cadas Bay ...		3·50	0·67	2·47	2·34	3·09	5·76	2·74	2·60	3·50	4·91	4·91	2·12	40·71

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—Yes.

(*b*) Number of children examined for enlarged spleen, none. Percentage affected.—None. Does kala-azar exist?—No.

(*c*) Number of persons examined for filarial diseases.—None.

(*d*) Any large works for surface drainage of towns or reclamation of marshes.—None.

(*f*) Amount of Government quinine sold or distributed gratis during the year.—£15. Agencies employed.—Police stations.

(*g*) Is quinine distributed regularly in the schools?—No.

(*h*) Measures taken against these diseases on estates employing indentured labour.—None.

(*i*) Any steps taken regarding the housing of the poor.—None except the Poor House.

(*k*) Any other remarks on the subject.—No cases of yellow fever, dengue, or kala-azar.

W. M. McDonald,
Medical Superintendent,
Holberton Hospital.

APPENDIX II.

Report of the Professor of Protozoology at the University of London for the year ended June 30th, 1913.

(Received 20 August, 1913.)

My work during the year covered by this report has been carried on at the Lister Institute, but I regret to state that it suffered an unfortunate interruption due to ill-health. In November last my medical adviser ordered me to take at least a month's holiday in a warm climate. Having reported this to the University authorities and obtained their concurrence, I left England on the 4th December for North Africa, and returned to London in the second week in January, in time for my course of lectures, which began on January 20th. The time I spent in North Africa was not wholly wasted, however, as I was able to visit the Pasteur Institutes at Algiers and Tunis, where I was received most kindly by the Directors, Dr. Edmond Sergent at Algiers, and Dr. Charles Nicolle at Tunis, and was able to acquire much valuable information and obtain important material, as set forth more fully below.

There are no changes to report with regard to the *personnel* of this Department.

The account of my own work during the year may be divided, as in previous reports, into (1) research and (2) teaching work.

1. *Research.*—I have been occupied chiefly in continuing investigations jointly with Dr. J. D. Thomson upon *Trypanosoma lewisi.* I had hoped that I should have been able to announce in this report the entire completion of this investigation, and that it would have been by now, if not actually published, at least in the press. Circumstances, however, to which reference has been made above, have delayed my work and set me back considerably. We are now engaged in writing up all our results, putting them into final form, and filling such gaps as still exist in matters of detail, and I sincerely hope that the end of the current year will see the complete memoir describing this investigation out of our hands.

A few points with regard to this investigation, supplementing my former reports, may be mentioned briefly.

(*a*) *Transmission.*—In my former report ([Cd. 6669], p. 67), I referred to the researches of Nöller, and especially to his conclusion that the trypanosome passes out of the flea with the fæces and thus infects the rat, which licks the fæces off its skin. Nöller's statements received strong confirmation from the experiments reported by Wenyon ([Cd. 6669], p. 91). We held a contrary opinion, and believed that the trypanosome was regurgitated forward from the stomach of the flea through the proboscis, and entered the rat by inoculation through the skin.

We have performed a number of experiments to test this divergence of opinion, but have failed entirely, I regret to say, to obtain any positive support for our own view, namely, that the trypanosome is inoculated into the rat through the proboscis of the flea. Our experiments were mainly of two kinds.

(i.) Feeding fleas under observation on healthy rats.—The fleas were in all cases known to have fed on an infected rat at least seven days previously. They were placed singly on a shaved area of the skin of the rat, and the process of feeding watched under a lens. The moment the flea withdrew its proboscis after satisfying its hunger it was recaptured; for this purpose an ordinary camel's hair paint-brush dipped in sugar-syrup was found most effective. When a batch of fleas had been fed in this way on the rat, the skin of the rat was carefully washed with a disinfectant before the rat had had time or opportunity to lick itself, in order to prevent any possibility of the rat becoming infected by licking fæces of the fleas from its skin. As a matter of fact, however, it has been our invariable experience that *Ceratophyllus fasciatus*, the rat-flea, does not defæcate on the rat's skin while feeding; in this respect our observations contrast with those of Nöller and Wenyon, who made use in their experiments of tethered specimens of the dog-flea and of the human *Pulex irritans.* In one case, however, a flea which had eluded capture and escaped into the fur of the rat was found to have defæcated there.

When the experiment was finished, the recaptured fleas which had been seen to feed were dissected and examined; the "militants" which had refused to feed were either remanded to their test-tubes and given another chance to feed on the following day, or were also dissected at once, as controls. In this way we were able to ascertain that well-infected fleas had fed upon the experimental rat,

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A large number of such experiments have been performed, and all with the same invariably negative result; not one of the rats used in these experiments became infected.

(ii.) Experiments with the infected breeding-cage. As I have mentioned in former reports, in some of our breeding-cages for fleas an infected rat is always kept, so that the fleas ingest blood containing trypanosomes every time they feed. A cage of this kind is extremely useful, since if it be desired at any time to obtain an infected rat, it is sufficient to remove the infected rat from the cage for one night and to put a clean, *i.e.*, non-infected rat in its place; the clean rat thus substituted acquires the infection in due course, practically without fail.

In order to test the mode of infection we performed a number of experiments which consisted of putting into the infected cage a clean rat which had been muzzled, so that it could not lick itself or catch and devour the fleas that troubled it. To ensure this result it was necessary also to tie back the fore-paws of the rat, otherwise it would soon get its muzzle off. After the rat had been in the infected cage for a given time, usually a night, it was removed, and its fur carefully washed all over with a disinfectant before it was unmuzzled. In many cases it was observed that the liquid used for washing became quite reddish in tint from the flea-fæces in the fur.

Every one of these experiments, when carried out efficiently, gave a negative result, the rat in no case becoming infected. On the other hand, control rats (not muzzled) became infected, and in one experiment a rat which succeeded in getting its paws free and disembarrassing itself of its muzzle during the night contracted an infection in due course.

The results of these various experiments were, therefore, entirely negative as regards infection of the rat by inoculation through the proboscis of the flea, and support the conclusions of Nöller and Wenyon, namely, that the rat becomes infected by licking the fæces off the skin. The experiments with muzzled rats prove also that the infection does not pass directly through the skin from fæces deposited upon it; the muzzled condition excludes only infection by way of the mouth. Whether this rule can be made absolute, whether, that is to say, it can be positively affirmed that the flea never does and never can infect by inoculation through the proboscis, remains still an open question from a strictly logical point of view, but failing any positive experimental results it must be acknowledged that inoculative infection by the flea can no longer be considered a practical possibility.

Since it is well known that the rat can become infected by eating infected fleas, we performed some experiments to determine whether such infection can take place before the trypanosomes have completed their developmental cycle in the flea, the duration of the cycle having been shown to be about six days. The experiments were conducted as follows. On the Thursday in each week a batch of about 200 fleas were collected from a non-infected breeding-cage and kept without food till the Sunday following, when they were put on a well infected rat. On the Tuesday following about 40 or 50 of the fleas were recovered from the infected rat, each flea decapitated and the carcase of the flea, containing the entire digestive tract, given to the rat in a pellet of moist bread. There was no difficulty at all in getting the rats to eat the fleas in this way. Tuesday's rat was known as the " two-day rat," since the infection was two days old in the fleas. In like manner another lot of the same batch of fleas was administered on Thursday to another rat, the " four-day rat," and another on Saturday to the " six-day rat." (All that could be found remaining of the fleas had been removed from the infected rat on the Friday, and those that were left after Saturday's feeding were kept for the experiments already described, in which the fleas were fed under observation on clean rats, on the Monday, Tuesday, and Wednesday following.)

These experiments were continued with the same regular and unvarying routine for thirteen weeks. As a result two of the six-day rats became infected, but not in a single case did any of the two-day or four-day rats acquire an infection. This result indicates that a rat can only be infected through having eaten an infected flea if the developmental cycle of the trypanosome has been completed in the flea.

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(b) *Development.*—In my last report ([Cd. 6669], pp. 69-72), I gave a résumé of our results and conclusions concerning the development of *T. lewisi* in the flea. We have been occupied chiefly in elaborating points of detail and in working out particular phases of the development about which we were not quite clear. Recently we have been cutting fine sections of the stomach of the flea in order to study in minuter detail the stage of the development in which the flea multiplies within the epithelial cells. This is a tedious business, since it is not possible to ascertain whether a given stomach contains such stages before cutting sections of it, so that an enormous amount of time is wasted in cutting sections which, when examined, are found to contain nothing of interest.

2. *Teaching work.*—During the months of January, February, and March I gave a course of twenty lectures on protozoa generally, at the Lister Institute on Mondays, Wednesdays, and Fridays, at 5 p.m. As usual each lecture was followed by a demonstration of microscopical preparations illustrative of the subject of the lecture. The attendance at the course averaged about 25.

I also gave a popular lecture on " Sleeping Sickness " at Birmingham, in November, under the auspices of the Research Defence Society.

A number of workers have occupied places in my laboratory during the past year, and have received informal assistance from me or my assistant.

Dr. J. D. Thomson and Dr. W. Cecil Bosanquet have been at work here all the year, so far as their other duties permit. Dr. Thomson has been collaborating with me in researches upon *Trypanosoma lewisi*, as already reported, and Dr. Bosanquet is engaged at present in studying the peculiar parasite of guinea-pigs formerly known as " Kurloff's bodies," recently named *Lymphocytozoon cobayæ* by E. H. Ross.

Major S. R. Christophers, I.M.S., came to us in January, and has been engaged in general studies upon protozoa and protozoological technique, and upon the anatomy and histology of the flea. In both these fields he has made interesting and important observations, which I hope he will find leisure to work up for publication.

Major E. L. Perry, I.M.S., has been working here since May upon lines similar to those taken by Major Christophers.

Mr. Andrew Cunningham has been at work here from January to Easter, attending my course of lectures and studying protozoa generally, and especially methods of technique, with a view to investigations upon organisms in the soil.

Mr. G. Lapage, B.Sc., worked here from August to Christmas last, when he left us to take up an appointment as assistant in the Zoological Department at Manchester University. His object was to acquire a general knowledge of protozoa and of technique, and he collaborated with Dr. Woodcock in the study of various flagellates, as described below in Dr. Woodcock's report.

Dr. F. Tidswell, Director of the Government Bureau of Microbiology, New South Wales, was working here from January to May last, studying protozoa generally and technique.

Mr. T. Goodey, M.Sc., then assistant in the Rothamsted Experimental Station, worked here during May and June on protozoa from " sick soils."

Mr. C. H. Martin visited the laboratory from time to time, continuing his investigations on various protozoa, especially those occurring in the soil.

Miss Helen Pixell (now Mrs. E. S. Goodrich), whom I mentioned in my last report amongst the workers here, and who has now been appointed to a Beit Research Fellowship, has been working here since the beginning of the year continuously on material brought back by me from North Africa under the following circumstances :—

When in Tunis at the new year I desired particularly to see specimens of the curious parasite *Toxoplasma gondii*, discovered by Dr. Nicolle in a small desert rodent, the gondi (*Ctenodactylus gondi*). The parasite was regarded by its discoverer at first as a species of *Leishmania*, and resembles the members of this genus superficially, more especially in its mode of parasitism; but on closer investigation it proved to be quite distinct from *Leishmania*, in being without a kinetonucleus in its ordinary state as an intracellular parasite and in not giving rise to any flagellated stage in cultures; consequently the new genus *Toxoplasma* was founded for it by Nicolle and Manceaux. Other species of the genus have since been described, parasitic in the rabbit, dog, mole, mouse, and pigeon in other parts of the world; since

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some of these are very pathogenic to their hosts, they are likely to become of economic importance.

Dr. Nicolle most kindly gave me the choice of his own preparations of *Toxoplasma*, and also presented me with two mice which he had inoculated with the parasite; these I brought back to England with me. Mice infected with *Toxoplasma* seldom live more than a week, but fortunately both my infected mice reached London alive, though one died the night after my arrival. From these two mice I was able to inoculate others, and so keep up the strain; and I handed all the material over to Miss Pixell for study. She made a detailed cytological investigation of the parasite, which had never been done before, and also found some interesting new facts with regard to its mode of parasitism, especially its occurrence in the large endothelial cells and macrophages of the peritoneum. (It would be interesting to know if the *Leishmania* of kala-azar also occurs in this situation.) Miss Pixell has presented a memoir on *Toxoplasma* to the Royal Society; it is now in the press, and will appear in the Proceedings.

Toxoplasma, while parasitic in its vertebrate host, appears only in one single form, and undergoes no sort of development except multiplication by binary fission of a very simple and primitive type; consequently the study of the parasite in mice or other experimental hosts, or in its natural host, the gondi, affords no clue to the natural affinities and systematic position of the parasite. It remains at present unclassifiable, and in my book it received brief mention (p. 387) amongst a few genera which at present are *incertæ sedis*. In order to solve the problem of its true nature, it is most desirable to obtain information with regard to its natural method of transmission from one vertebrate host to another; and further, if, as is very probable, the transmission is effected by the agency of some intermediate host, to study its development in the intermediate host, whatever it may be. Investigations of this kind could only be carried on properly in places where *Toxoplasma* is a natural, indigenous parasite; accordingly, Miss Pixell undertook to go to the desert and study the gondi and its parasite in their natural haunts. She left for Tunis shortly after Easter and worked for some time under Dr. Nicolle in the Pasteur Institute there; then she went south to the plateau of Matmata in the Tunisian desert, where gondis are fairly abundant. Dr. Nicolle made all arrangements for her, and placed one of his assistants under her orders; at Matmata she was the guest of the French military authorities, who were most kind and hospitable. Unfortunately, although she obtained and examined a large number of gondis, she was not successful in finding a single animal infected with *Toxoplasma*, and all inoculations of experimental animals from gondis remained entirely without result. It is possible, as Dr. Nicolle thinks, that the infection of the gondis with *Toxoplasma* is a seasonable one, and that the time of Miss Pixell's visit to Tunisia was not the right period of the year, a state of things which could not have been foreseen from any data available.

Although Miss Pixell's expedition failed in its principal object, the investigation of the transmission of *Toxoplasma*, she was able to collect and bring back some interesting material for study, including ectoparasites from the gondi and some parasitic protozoa from other hosts. The problem of the affinities of *Toxoplasma* remains to be solved; I should like to mention, however, that some authorities, as I am informed, are inclined to regard this parasite as being of the nature of a yeast or fungus; but Miss Pixell's investigations lend no support to any such hypothesis, and having seen her preparations I am entirely of her opinion that *Toxoplasma* is a true member of the phylum protozoa, though it is not possible as yet to assign to it a definite position in the phylum.

In addition to giving assistance to those who are working in my laboratory, I have a good deal of correspondence with various people at home or abroad who consult me on various points, and frequently send me specimens to examine and report upon; amongst whom I may mention especially Captain F. P. Mackie, I.M.S., on special duty with the kala-azar enquiry, with whom I have been in regular correspondence. The authorities of the Natural History Museum consulted me with regard to the preparation of models of the life-history of the malarial parasite and

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other exhibits for the Ghent Exhibition. I have also assisted to revise the nomenclature of protozoa causing disease in man for the Committee on Nomenclature of Diseases of the Royal College of Physicians. In these miscellaneous ways a good deal of my time is taken up, though not, I trust, unprofitably.

Appended will be found a report by my assistant, Dr. H. M. Woodcock, and a list of works published from this Department during the year covered by this report.

Report by H. M. Woodcock, D.Sc. Lond., Assistant to the University Professor of Protozoology, for the Year ending June 30th, 1913.

My research work during the year under review has dealt with two entirely distinct subjects, namely, (*a*) a remarkable parasite of the goat and other ruminants and certain flagellates which develop in goat-dung; (*b*) the possible transmissive agent or agents of the blood-parasites of common British birds.

(*a*) I was led to the discovery, or, more correctly, the re-discovery, of a very peculiar and characteristic parasite of the goat in the course of a study of certain flagellates which are merely "passive travellers," as I propose to denote them, through the alimentary tract. This study is one which I am pursuing in collaboration with Mr. Lapage, B.Sc., of Manchester University, who came to work in this laboratory in the early autumn. Our work upon these flagellates, which we intend to continue, had already been productive of important results, to which I refer briefly below, but it was temporarily suspended in order to concentrate our attention upon the remarkable organism which we found, as it were, accidentally. We were examining the rumen of a goat which had been killed, in order to ascertain which, if any, of the flagellates which developed in our dung-cultures were present in an active condition in the digestive tract itself. In a small drop of the fluid contents of the rumen we found besides a certain number of the well-known heterotrichous ciliates an enormous number of much smaller organisms. These were of two kinds, which we have distinguished as crescents and ovals; both forms, however, were very similar in general appearance. A few of the crescents were languidly motile, and after a while we were able to make out that they possessed a distinct flagellum; this flagellum did not appear to be situated terminally, but emerged from the body at some point along the concave side. The body-protoplasm appeared quite homogeneous in structure, both in the crescents and ovals. So much for the first observation of the parasite. As a result of later examinations, we have been able to learn considerably more by observation of the living organisms, particularly with regard to their motility. The rumen-contents in which we found the parasite originally had grown quite cold, for we had taken samples first from all the different regions of the killed animal, placing them in small dishes for subsequent examination. In common with the characteristic ciliates, this new organism, as a rule, very rapidly loses its power of movement when it is removed from its natural environment—the fall in temperature alone sufficing to render nearly all the individuals motionless. Hence we have had to be very careful to keep the portion of the rumen-contents removed for examination at approximately the body-temperature of the warm-blooded host. We have sent off a detailed description of the parasite for publication in the Quarterly Journal of Microscopical Science, and I may give here a summary of our paper.

The new generic name *Selenomastix* is proposed for the parasite; the specific name must be *ruminantium*, after Certes, as this worker, many years ago, recorded the original observation of the crescents, and regarded them as representing a flagellate of the genus *Ancyromonas*. The parasite of the goat has assuredly no connection whatever with this typical flagellate, which is, moreover, a marine form. The principal habitat of *Selenomastix* is the rumen, especially of the goat; we have found it also in the sheep, and it occurs most probably in other ruminants as well. It occurs also in the reticulum, but sparingly; we have never seen it, at any rate, in the form of the ordinary crescents or ovals, in any part of the intestine or cæcum. The crescents always present a homogeneous, non-granular appearance, and are free from vacuoles. They possess a definite envelope, which is not, however, conspicuous in life. A single flagellum arises, usually about the middle of the concave side, but

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it may be nearer one end, which is to be regarded as the anterior extremity. The method of movement is very varied. In some cases movement is effected by the flagellum, which is directed posteriorly, and acts as a pulsellum; in others, perhaps most often, the movement is produced by means of the body alone, the flagellum standing out passively from the side of the organism. It is to be noted that the crescents are never S-like or resembling a spirillum, and we have never noticed any spiral or corkscrew-like movement of the body around its own axis. There is no properly constituted nucleus, the chromatin being present in the form of a narrow, peripheral layer in which granules of varying size may occur; sometimes there are one or two large chomatin-masses projecting inwards into the cytoplasm. Division is usually taking place, and is always transverse to the long axis, by equal binary fission. The flagellum splits along the greater part of its length, always beginning at its proximal end. The ovals resemble the crescents in general, both as regards their appearance, their method of transverse division, and their ability to move by means of the body alone. The most important distinction is that they never possess a flagellum. (Neither the crescents nor the ovals it may be incidentally remarked show any trace of locomotor organellæ corresponding to bacterial " cilia " or " flagella " after special staining for this purpose.) The ovals show two types of minute structure :—(1) individuals in which the chromatinic substance occurs as a narrow peripheral layer with or without granules in it. This arrangement agrees closely with that obtaining in the crescents. (2) Individuals in the protoplasm of which two zones can be distinguished; a central, lighter-staining region, comparable to the cytoplasm of (*a*); and a peripheral, darker area of variable extent. This latter may be chromatinic in nature, the chromatin being perhaps in a very fine, diffuse condition and permeating the general protoplasm of this zone. As regards the connection between these different forms of the parasite, we consider that the second type of oval just mentioned gives rise to the first type; and also, that the first type of oval may probably be developed from the crescent. We have no indication as to whether the ovals can give rise to crescents. Up to the present we remain rather in the dark as to the affinities of *Selenomastix ruminantium*, since this remarkable parasite differs in important respects from any ordinary flagellate.

Among the flagellates which develop in simple cultures of goat's-dung, we have devoted particular attention to certain forms of the genus *Bodo* (using this name for the moment in its accustomed, wide sense), to *Cercomonas longicauda*, and to an entirely new type, which we have not yet named. As regards the bodos, we have found that at least one species is a true *Bodo*, that is to say, it does not possess anything in the nature of a kinetonucleus; another species, on the contrary, does possess such an organella we are inclined to think. At any rate, Alexeieff's sweeping assertion that all bodos are really prowazekias is certainly erroneous. As regards *Cercomonas* we have arrived at the interesting conclusion that the posteriorly directed " tail " is not exactly comparable to an ordinary flagellum; neither is it an internal rhizoplastic element. It appears to be an organella *sui generis*. The new type of flagellate is distinctly remarkable in that it is otherwise quite like a (true) *Bodo*, but lacks entirely an anterior flagellum. The single flagellum is always posteriorly directed and acts, at any rate usually, in the same manner as the trailing flagellum of a *Bodo*. As we have not yet finished working on this interesting material, I am unable to say more about our results at present.

(*b*) In my investigations on the transmission of the blood parasites of the chaffinch my attention was directed during the autumn and again during the early spring to a remarkable natural infection of the common gnat, *Culex pipiens*, which appeared to me well worth further investigation. Towards the end of September Mr. Bacot, Entomologist attached to the Lister Institute (to whom I am greatly indebted for the trouble he has taken and the help he has given me), brought me some hibernating females of *Culex pipiens* caught in the cellar of his house. No males were found in the cellar, which is dark and rather damp. On examining one of these gnats I was greatly surprised to find the intestine crammed with flagellates of the species commonly known as " *Crithidia* " *fasciculata*, the true nature of which has been the subject of much discussion; some investigators regard these flagellates as constituting an independent species, parasitic in the gnat alone, and believe that no

part of their life-cycle is passed in any other host but the insect; others incline to the opinion that they represent merely crithidial stages of a trypanosome parasitic in the blood of some vertebrate and possessing, like other trypanosomes, an alternation of generations corresponding to an alternation of hosts, vertebrate (bird?) and invertebrate (gnat).

The flagellates in question occur for the most part in the resting phase, attached by their flagellar ends to the wall of the intestine and carpeting its surface; some, however, form large rosettes free in the intestine and blocking its lumen. The great majority have the typical form known as the " grain d'orge " from which the name *Crithidia* is derived; none of them were rounded off, and it is most important to emphasise that none of them are encysted. The flagellum is always present; in most its free portion is only a spike-like projection, but in the autumn a very few, still active individuals, in which the flagellum was fully developed, were seen near the pyloric end of the stomach. As soon as any of the liquid, whether water or salt-solution, in which the examination of the digestive tract was made, came in contact with the parasites, they became active, many of them breaking away from the cluster of which they formed part, and swimming about vigorously; the flagella of such individuals must have developed almost instantaneously to their full length. This phenomenon was observed in the case of the flagellates in any part of the intestine, at the rectal end as much as in any other region.

With a view to seeing whether these flagellates would persist alive in the gnats and in the same condition through the winter, the attempt was made to keep a number of gnats alive until the spring. Unfortunately nearly all those kept in captivity were killed off by a blue mould, and at the end of March only three, which had been left in the cage and not specially cared for, remained alive, the sole survivors of forty collected in the autumn. Mr. Bacot was able, however, to find several more in his cellar, and in 40 per cent. of these and in one of the three that survived in captivity, the crithidiæ were present and alive. Broadly speaking the parasites in the gnats which had undergone hibernation were in the same condition, and occurred in the same numbers as in those examined in the autumn.

With regard to the natural destiny of these crithidial parasites, I have at present only negative evidence to offer, but it is, in my opinion, very suggestive. It is believed by many that the parasites pass out of the mosquito in an encysted condition in the fæces, and thus contaminate the water and ultimately the food of mosquito-larvæ, and so establish themselves in a fresh generation of their insect hosts. In the spring batches of the crithidiæ, which had become active after contact with water in the manner described above, were kept by me either in water or in salt-solution. After twenty-four hours only a small number of normally active individuals were to be seen; others were very languid, the flagellum moving feebly, and many had died off or disappeared. After forty-eight hours only a few solitary individuals could be found alive in the watery medium. But in one preparation it was observed that a considerable number of parasites which had remained enclosed within a portion of the digestive tract, namely, the pyloric end of the stomach and the proximal region of the intestine, were quite normal and active after forty-eight hours, and several of these were still active on the following day, when there was no sign of living individuals in the water around. These observations indicate that the crithidiæ are not able to live for any length of time in water, outside the body of their host, and this is only what was to be expected, since the parasites were not in an encysted condition.

There are, moreover, other considerations which make it difficult to suppose that these crithidial parasites are destined normally to be taken up by mosquito-larvæ, especially the fact that in the great majority of cases at least there can be no larvæ available to act as hosts at the time when the parasites would be passed out from the mosquito. Before there can be larvæ the hibernating gnats must mature their eggs, which they most probably cannot do without a meal of blood. Fæces are evacuated very soon after a meal, and with the fæces a number of the parasites would be passed out, but there is no reason to suppose that this would take place in the neighbourhood of water. In Mr. Bacot's cellar the exodus of the hibernating

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gnats was observed to take place between the end of March and the middle of April, the last two females being captured on the 16th April. Only the crithidial parasites of those which awoke last from their winter sleep would have any chance of finding larvæ to infect, since at the very least ten days must elapse from the time a female gnat fed until there could be any larvæ, bearing in mind the slowness with which digestion takes place at spring temperature.

To test the question of the infection of the mosquito-larvæ further, after the female gnats had all disappeared from his cellar Mr. Bacot placed vessels containing water in his garden for the larvæ to develop in. Later numerous larvæ of different ages and broods were brought to me from these receptacles, all without exception larvæ of *Culex pipiens*. I examined a great many of these larvæ without finding in a single case any infection in them of flagellates, whether in the active or resting condition. I have also examined hundreds of larvæ and newly-emerged imagines, both male and female, of *Culex pipiens* from various sources during the past few years, without finding any parasitic flagellates in them.

On the supposition that the crithidial parasites of the mosquitoes are destined normally to pass into the blood of a bird and give rise to a trypanosome-infection, attention may be drawn to certain possibilities in their subsequent history. It is possible that the fæces containing the parasites might be evacuated while the gnat is actually feeding on a bird and bring about an infection by dropping on to some exposed part of the skin. On the other hand, the possibility of inoculative infection must also be kept in mind. *Culex pipiens* is essentially the British mosquito which feeds on birds' blood. About a week after Mr. Bacot brought me the last hibernating gnats he captured a solitary female in his garden which contained fresh blood; when examined this proved to be avian blood, but unfortunately there were no flagellates in this gnat. Since the flagellates would undoubtedly become active when fresh liquid blood reached the intestine, some of them would be able to pass forwards into the stomach, and repopulate it with parasites. It remains to be ascertained whether from certain of the flagellates inoculative forms would be produced which could infect a bird at a subsequent meal.

In this connection there are some important points in the bionomics of mosquitoes which must be settled before it can be regarded as certain that the crithidiæ are derived from some hæmoflagellate. Amongst the mosquitoes "summer females," which produce larvæ during the season, must be distinguished from "autumn females," which hibernate and produce larvæ the following year. As regards the summer females, I find that those bred in captivity will always take a meal of blood before being fertilized. After this first meal the eggs develop to their full size, ripe for fertilization. In the early part of this summer I have succeeded in obtaining fertile egg-rafts and young larvæ from bred-out males and females. I believe that normally a second meal of blood is taken before the fertile eggs are laid, and that this meal induces the oviposition. I have found this to be the case in at least two instances, and I have also noticed that a gravid female which has not fed a second time has not infrequently laid her eggs, which, however, have been infertile. It is quite possible that fertilization stimulates the female, as it were, to another meal of blood. On the other hand, in the hibernating females, all of which were found to have been fertilized, the eggs were quite small and immature. There are three possible alternatives with regard to these hibernating gnats: first, that they had never taken blood, in which case it is obvious that the crithidiæ could not have developed from a Hæmoflagellate (trypanosome); secondly, that after one or more meals of blood they had matured and laid a batch of eggs, and that the young eggs present in them represent a later batch; thirdly, that in the case of an autumn female which is about to hibernate the ovarial conditions are different, and the eggs do not develop immediately as the result of a meal of blood. The second of these suppositions seems to me the most probable, but I hope to determine in due course which of these explanations is the right one; for the present the problem must be left at this interesting stage.

A few words, lastly, with regard to the possible transmission of any of the blood-parasites of the chaffinch by the agency of bird-fleas (*Ceratophyllus gallinæ*), to which I referred in my last Report [Cd. 6669]. I paid particular attention to

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Halteridium fringillæ in this connection, since it is not improbable that this parasite is transmitted only by some blood-sucker which bites frequently, at short intervals. Last summer I was able to carry out several experiments with this species of flea, but unfortunately could never obtain the true finch-flea (*C. fringillæ*). I need not detail the experiments here as they all yielded a negative result. None of the birds on which I allowed fleas to feed, after different intervals of time had elapsed since they had fed on a bird well infected with *Halteridium*, became infected. The experiments were scarcely sufficiently exhaustive, however, for me to say with certainty yet that the fleas cannot transmit this parasite, and I am conducting some more experiments this summer. Nevertheless, the indications that I obtained pointed to this conclusion. The disruption and dissolution of the blood-corpuscles in the stomach of the flea takes place with very great rapidity—very much more rapidly than in the mosquito; and the parasites appear to vanish just as quickly. On one or two occasions I have seen a few ookinetes on dissecting a flea five or six hours after it had fed, but never after a longer interval. At the end of twenty-four hours or more I have never seen any trace left of the *Halteridium*, and as a flea will not feed again sooner that this it does not appear probable to me that this insect acts as an intermediate host for this parasite.

Departmental work.—I have assisted Professor Minchin in the general work of the laboratory during the past year. During the spring term I was much occupied in arranging the demonstrations in connection with his annual course of lectures, which were given thrice weekly.

H. M. Woodcock.

List of Publications relating to Investigations carried on wholly or in part at the University Department of Protozoology.

By Professor E. A. Minchin :—

(1) Speculations on the Origin of Life and the Evolution of Living Beings. (Opening Address in a discussion on the Origin of Life at a joint meeting of the Botanical and Zoological Sections of the British Association, Dundee, Sept. 10, 1912.) *Science Progress* No. 26, Oct., 1912, pp. 300-311.

By Dr. H. M. Woodcock :—

(2) Notes on Sporozoa. Nos. II.-IV. *Quart. Journ. Micr. Sci.*, Vol. LVIII., 1912, pp. 171-240, pls. ix., x. (Vide [Cd. 6669], p, 75.)

(3) Protozoa. Zoological Record for 1911, Vol. XLVIII., 1912, 67 pp.

By Mr. C. H. Martin :—

(4) Some Remarks on the Behaviour of the Kinetonucleus in the Division of Flagellates : with a Note on *Prowazekia terricola*, a new Flagellate from Sick Soil. *Zoologischer Anzeiger*, Vol. XLI., pp. 452-456, 8 text-figg.

(5) Further Observations on the Intestinal Trypanoplasmas of Fishes, with a Note on the Division of *Trypanoplasma cyprini* in the Crop of a Leech. *Quart. Journ. Micr. Sci.* Vol. LIX., pp. 175-195, pls. ix., x., 2 text-figg.

By Dr. Arrigo Visentini :—

(6) On the Morphology of the Leishmania of Italian Kala-azar. Third Communication : Cytological Researches on *Leishmania* in Cultures. *Quart. Journ. Micr. Sci.* LVIII., pp. 353-371, pls. xix., xx. (Vide [Cd. 6669], p. 72.)

(7) The Transmission of Leishmaniasis by means of Cultures, and the Mechanism of the Natural Immunity in Rats and Guinea-pigs. *Ibid.*, Vol. LVIII., pp. 373-384, pl. xxi. (Vide [Cd. 6669], p. 72.)

APPENDIX III.

Report by Professor G. H. F. Nuttall, F.R.S., on the work of the Quick Laboratory, Cambridge.

The appended list of twenty-three papers published by the workers in the Quick Laboratory during the year 1913 indicates the character of the investigations which have been conducted.

The papers deal with pathogenic protozoa and the diseases they cause, the structure and biology of ticks, and observations upon the biology of insects. The names of Messrs. Cunliffe, Hadwen, Hindle, Johnson, Lewin, Merriman, Nicholls, Warburton, and of Miss Porter, and myself, appear as authors of these papers.

Mr. K. R. Lewin, B.A., who held the post of assistant to the Quick Professor for nine months, having been appointed Protozoologist to the Rothamsted Experimental Station, Harpenden, Herts, was succeeded in the assistantship by E. Hindle, B.A., Ph.D., lately Beit Memorial Fellow for Medical Research.

Miss A. Porter, D.Sc. (London), was appointed by me to be Helminthologist to the laboratory in September, 1913, work on parasitic worms having become necessary in consequence of the material, derived from many sources, which is accumulating on our hands. It has been possible to establish the post of Helminthologist this year owing to the aid of the Tropical Diseases Research Fund.

The regular staff of the laboratory at present, therefore, is constituted as follows:—

Professor G. H. F. Nuttall, F.R.S., Director.

Research Workers.

Mr. C. Warburton, M.A., Demonstrator in Medical Entomology;
E. Hindle, B.A., Ph.D., Assistant to the Quick Professor;
Miss A. Porter, D.Sc. (London), Helminthologist to the Quick Laboratory;
Mr. N. Cunliffe, B.A., Student in Medical Entomology.

Laboratory Assistants.

Mr. E. S. Hay, Secretary;
Mr. B. G. Clarke, Senior Laboratory Assistant;
Mr. C. H. Harpley, Junior Laboratory Assistant.

In addition to the members of the staff, who have been continuously at work, we have had the following gentlemen engaged in research in the laboratory during the year 1913: Dr. Lucius Nicholls, late Pathologist to the Victoria Hospital, St. Lucia, West Indies, worked here from November, 1912, to June, 1913, mainly upon pellagra, a subject he had already been studying in the West Indies; he has since gone to Africa. Dr. Seymour Hadwen, Pathologist to the Canadian Department of Agriculture, came to us from Agassiz, British Columbia, and worked in the laboratory from July to October; he has since returned to Canada. Dr. J. C. Johnson, of Cork, who worked in the laboratory during June-August, has recently been appointed to a Chair of Biology in New Zealand. Major S. R. Christophers, I.M.S., Superintendent of the King Institute of Preventive Medicine, Madras, left us in January, having completed the work he had undertaken here.

The most interesting results of research obtained during the year are perhaps those relating to the conditions influencing the transmission of East Coast Fever (paper No. 19), the reproduction of Canadian "tick paralysis" in a dog in Cambridge by means of a single imported tick (18), and the observations of parthenogenesis and variability in ticks under experimental conditions (9-11). Since our paper on "tick paralysis" appeared further reports of cases occurring in man have reached the writer from Oregon. The Herter lectures (3, 4, 20) incorporate the results of original work, especially in relation to piroplasmosis.

Through an extensive correspondence with scientific workers in all parts of the world, I have been collecting data regarding the distribution of tick-transmitted

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diseases and ticks, which will be of considerable interest when arranged for publication. A very great [quantity of] material bearing on these subjects is being accumulated, studied and classified. Specimens reach the laboratory daily, and reports thereon are continually being sent to correspondents and collectors.

Were it not for the generous help afforded by the Tropical Diseases Research Fund it is clear that the work of the laboratory could not be continued on anything like the present scale.

GEO. H. F. NUTTALL,
Quick Professor of Biology in the University of Cambridge.

22nd December, 1913.

List of Publications for the Year 1913.

1. Porter, A. (1912-1913). Some Effects of the Occurrence of Myxosporidia in the Gall Bladder of Fishes. *Ann. Trop. Med. and Parasitol.*, VI., 467-481, 15 tables. (Written in conjunction with Dr. H. B. Fantham.)
2. Nuttall, G. H. F. (I. 1913). In Memoriam : Wilhelm Dönitz. *Parasitology*, V., 253-261, with portrait, pl. XIII.
3. Nuttall, G. H. F. (II. 1913). Lectures on the Herter Foundation. Lecture I.—Spirochætosis. *The Johns Hopkins Hosp. Bull.*, XXIX, 33-39, figs. 1-9. See also *Parasitology*, V., 262-274.
4. Nuttall, G. H. F. (III. 1913). Lectures on the Herter Foundation. Lecture II.—Trypanosomiasis. *The Johns Hopkins Hosp. Bull.*, XXIV., 83-89, figs. 10-12. See also *Parasitology*, V., 275-288.
5. Nuttall, G. H. F. (IV. 1913). Note on Colouration in Ticks. *Parasitology*, VI., 49-51, pl. VII.
6. Nuttall, G. H. F. (IV. 1913). Observations on the Biology of Ixodidæ. Part I. *Parasitology*, VI., 68-118, 2 figs.
7. Warburton, C. (VII. 1913). On four new Species and two new Varieties of the Ixodid genus *Hæmaphysalis*. *Parasitology*, VI., 121-130, 8 figs.
8. Nuttall, G. H. F. (VII. 1913). Notes on Ticks; III.—On four new Species of *Ixodes*. *Parasitology*, VI., 131-138, 4 figs.
9. Nuttall, G. H. F. (VII. 1913). Parthenogenesis in Ticks. Preliminary note. *Parasitology*, VI., 139-140. (Abstract in *Proc. Cambr. Philos. Soc.*, XVII., 241.)
10. Nuttall, G. H. F. (VII. 1913). *Rhipicephalus appendiculatus:* Variation in Size and Structure due to Nutrition. *Parasitology*, VI., 195-203, 4 figs. (Abstract in *Proc. Cambr. Philos. Soc.*, XVII., 241.)
11. Cunliffe, N. (VII. 1913). The Variability of *Rhipicephalus pulchellus* (Gerstäcker, 1873), together with its Geographical Distribution *Parasitology*, VI., 204-216, 6 figs.
12. Porter, A. (VII. 1913). Further Report on the Isle of Wight Bee Disease (Microsporidiosis). *Suppl. Journ. Board Agriculture and Fisheries*, XX., Suppl. No. 10, 1-47. (Especially Section I., in conjunction with Dr. H. B. Fantham.)
13. Nicholls, L. (VII. 1913.) Pathological changes in Pellagra and the production of the disease in Lower Animals. *Journ. of Hygiene*, XIII., 149-161, pls. IV. and V.
14. Hindle, E. (IX. 1913). A Chinese Flea-Trap. *Proc. Cambr. Philos. Soc.*, XVII., 284, 1 fig.
15. Lewin, K. R. (IX. 1913). The division of *Holosticha scutellum*. *Proc. Cambr. Philos. Soc.*, XVII., 241.
16. Lewin, K. R. (X. 1913). The nuclear structure and the sporulation process of *Agrippina bona* Strickland. *Parasitology*, VI., 257-264, pl. XVIII., 8 figs.
17. Johnson, J. C. (X. 1913). Observations on mammalian erythrocytes. *Parasitology*, VI., 276-278.

Appendix III.

REPORT BY PROFESSOR G. H. F. NUTTALL, F.R.S., ON THE WORK OF THE QUICK LABORATORY, CAMBRIDGE.

18. Hadwen, S., and Nuttall, G. H. F. (X. 1913). Experimental "tick paralysis" in the Dog. *Parasitology*, VI., 298-301.
19. Nuttall, G. H. F., and Hindle, E. (X. 1913). Conditions influencing the transmission of East Coast Fever. *Parasitology*, VI., 321-332.
20. Nuttall, G. H. F. (X. 1913). Lectures on the Herter Foundation. Lecture III.—Piroplasmosis. *The Johns Hopkins Hosp. Bull.*, XXIV., 307-316, 22 figs. See also *Parasitology*, VI., 302-320, 14 figs.
21. Nuttall, G. H. F. (1913). The training and status of Public Health Officers in the United Kingdom. *Trans. XVth Internat. Congr. Hyg. and Demogr.* (Washington, D.C., IX. 1912), 19 pp. (Reprinted in part in *Medical World*, London, I., 608-610.)
22. Nuttall, G. H. F., Hindle, E., and Merriman, G. (1913). Further experiments on the Range of Flight of *Musca domestica.*
    I. Nuttall, G. H. F. Introductory Note.
    II. Hindle, E., and Merriman, G. Report upon Experiments. *Reports to the Local Government Board on Public Health and Medical Subjects* (N.S., No. 85), 20-41, 13 charts.
23. Hindle, E. (1913). Note on the Colour-preference of Flies. *Reports to the Local Government Board on Public Health and Medical Subjects* (N.S., No. 85), 41-43.

APPENDIX IV.

Reports from the London School of Tropical Medicine.

No. 1.

LONDON SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 16 May, 1913.)

SIR, Royal Albert Dock, E., 15th May, 1913.

I HAVE the honour to submit herewith Reports of the Special Departments of the London School of Tropical Medicine for the half-year ended 30th April.

Dr. Leiper, the Helminthologist, has been on the West Coast of Africa during the last six months, and his duties in the School have been performed by Dr. H. M. Hänschell.

I am, &c.,
P. MICHELLI,
Secretary.

Enclosure 1 in No. 1.

REPORT OF THE HELMINTHOLOGIST FOR THE HALF-YEAR ENDING APRIL 30th, 1913.

The whole of my time for the past six months has been occupied by a visit to West Africa for the purpose of ascertaining the carrier of *Filaria loa*: the causal agent of Calabar Swelling. The results of the investigation are as follows:—

No evidence of infection was obtained from series of mosquitoes of various species fed upon a patient in whose blood very many filaria embryoes were present. With the same patient *Stomoxys calcitrans*, *Stomoxys nigra*, *Glossina palpalis*, *Cimex rotundatus*, *Pulex irritans*, *Tabanus par*, *T. socialis*, *T. fasciatus*, *T. secedens*, also gave negative results. In *Hæmatopota cordigera* and *Hippocentrum trimaculatum* I obtained a slight degree of infection but development was unequal and slow.

In *Chrysops dimidiata* and *Chrysops silacea* I obtained a rapid and uniform development of filaria diurna embryos taken up from a patient upon whom the flies had been induced to feed. No experiments were made with *Chrysops longicornis*. This species was only obtained once at Forcados, and none of the four flies which were captured could be induced to bite.

Chrysops appears to have a marked seasonal incidence and the experiments were brought to an abrupt close early in January owing to the lack of material.

Being advised that these flies would not become common again in Calabar until June, I proceeded to Lagos to investigate meanwhile the nature of the organisms reported as ankylostome embryoes which had been found in the wells of Lagos and Ebute Metta. These proved to be harmless free living nematodes, sexually mature, and showing but slight resemblance to the young of parasitic worms.

I then visited Lokoja to enquire into the frequency of *Filaria volvulus* in man. At Zungeru, however, as a result of some conversation with the Chief Secretary, I decided to visit Kano first and ascertain the extent to which the domesticated animals were infected with parasites, in view of important agricultural developments imminent in that district. The material collected there has not yet been fully examined, but it may be stated that the sheep, goats, and cattle are considerably less heavily infected with helminthes than in other parts of Africa. The ostriches, forming the nucleus of an ostrich farm which I understand will shortly be of considerable extent, were found to be entirely free from those parasites, which have led to such serious losses in South Africa.

Appendix IV.

REPORTS FROM THE LONDON SCHOOL OF TROPICAL MEDICINE.

At Lokoja, through the kindness of Dr. Daziel, we were able to note no less than 13, out of 168, prisoners with tumours due to *Filaria volvulus*. In none of these were embryoes found in the blood. Large numbers of living embryoes from a tumour were injected subcutaneously and intra-peritoneally into a monkey, but none ever appeared in the blood afterwards. The tumours were usually multiple, each containing two or more nodules. The usual site was the crest of the ileum; tumours were also noted over the sacrum and upon the ribs.

Specimens of *Stomoxys nigra* and *S. calcitrans* were fed artificially upon juice of tumours containing many living embryoes. Upon dissection later no evidence of infection of the flies was obtained, although the embryoes were found in the stomach contents. No other biting flies were available for experiment.

At Calabar I noted that the cases of guineaworm in the Hospital all came from the Upper Reaches of the Cross River, and from enquiry I ascertained that dracontiasis was quite unknown as a local infection. My tow nettings of likely waters in and around Calabar quite failed to supply me with cyclops for experimental purposes. From some mud from the same waters cyclops eventually developed, however, which indicated that they were being kept under control in some manner. Further investigation showed that in these waters were innumerable small fish, belonging apparently to the genus Haplochilus, which consumed cyclops, as well as eggs, larvæ and pupæ of mosquitoes, with avidity.

A series of experiments showed that these fish were very hardy and adapted themselves readily to confinement in small tanks of water. A number were afterwards taken to Lagos and were left with Dr. Adam Hutton to continue the experiments, especially with a view to determining the practicability of using them in wells containing cyclops.

If more extended experiments confirm our results, the introduction of these fish into the village ponds in those regions where guineaworm is endemic may prove the solution of a hitherto insuperable problem in the prophylaxis of dracontiasis. At least a plausible explanation is now suggested for the peculiarly patchy distribution of guineaworm in tropical countries, viz., the presence of " natural enemies " of cyclops.

R. T. Leiper.

Enclosure 2 in No. 1.

Report of the Entomology Department of the London School of Tropical Medicine for the Half-year ending 30th April, 1913.

Two sessions of the School came within this period, in each of which the usual course of lectures and practical demonstrations in Medical Entomology was given. In addition, two special courses of Entomology for officers deputed by the Colonial Office were conducted, one of them being attended by 13, the other by 25 officers. In these special courses, though the requirements of the medical and sanitary officer have a prominent place, certain other aspects of entomology, mainly economic, are also considered and discussed.

In this Department those bearings of zoology upon medicine that lie outside the purview of the protozoologist and helminthologist are included: no students entered for the special course in general medical zoology, but the ordinary course of lectures and demonstrations on venomous snakes and snake-venoms was given in each session.

Miss Summers, formerly Carnegie Scholar of the University of Aberdeen, continued her work in the laboratory until April 3rd.

Many additions have been made to the Departmental Museum and to the stock of teaching material, the most constant contributors being Captain W. F. Loughnan, R.A.M.C., who has sent numerous consignments of Anopheline mosquitoes from Northern India; and Dr. A. Connal and Dr. R. E. Drake-Brockman, who have sent large supplies of insects of well-known pathogenic interest from West and East Africa respectively. Other donors, to whom also thanks are due, are Dr. H. E. Arbuckle, Dr. Sinclair Coghill, Dr. W. E. Glover, Mr. M. Hoyte, Dr. W. B. Johnson, Dr. A. Lundie, Dr. W. A. Nicholson, Dr. G. F. Spurrell, and Dr. C. Watson—all

West Africa; Dr. H. Bayon, South Africa; Dr. G. Carpenter, Dr. A. Copland, and Mr. S. W. J. Scholefield, East Africa; Captain F. P. Connor, I.M.S., and Captain C. A. Gill, I.M.S., Dr. A. F. J. Kerr, Siam; Dr. C. L. Strangmann, Australia; Professor R. T. Hewlett, Professor G. H. F. Nuttall, and Dr. C. M. Wenyon.

The following papers have been published :—

(1) A synopsis of the genus Phlebotomus, by Miss Sophia L. M. Summers, M.A., B.Sc.
(2) A new species of Anopheles from the Malay Peninsula.
(3) On the species of Anopheles of the " Myzorhynchus " group.

A. Alcock,
Lieutenant-Colonel, I.M.S. (retired).

30th April, 1913.

Enclosure 3 in No. 1.

Report of the Protozoologist for the Half-year ending 30th April, 1913.

Teaching Work.

The usual classes in Protozoology have been held in both the Winter Sessions as usual and have involved teaching in the Protozoological section of the general course and in the advanced course. In addition to these regular classes a good deal of teaching is constantly going on in my Department out of the regular class hours for students come to examine material and specimens which are ready for any who care to avail themselves of such opportunity of study. In this way students are able to revise and continue the work which has been commenced in the regular course, and thus considerably enhance the value of the instruction they there receive.

Research Work.

Research work has been undertaken under the following headings :—

I. *Leishmania from South America skin lesions.*

I have already reported that I had obtained a virus from a case of dermal leishmaniasis from South America. This virus was maintained in culture form on N.N.N. medium and also by cutaneous inoculation of animals. Monkeys, dogs, and cats were used. In these animals lesions comparable to those seen in man were produced, but there was a tendency for healing to take place much more rapidly. The following passages were made in the various animals :—

```
                         Original Virus from Man.
                                    |
        ┌───────────────────────────┴───────────────────────────┐
Baboon (cynocephalus).                                         Dog.
 4 months' incubation.                                 3 months' incubation.
          |                                                     |
        Dog.                                                   Dog.
 23 days' incubation.                                  30 days' incubation.
                                                                |
                                                   ┌────────────┴────────────┐
                                                 Dog ?                      Cat.
                                                                    2 months' incubation.
                                                                            |
                                                               ┌────────────┴────────────┐
                                                             Dog ?                     Cat ?
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The inoculations in all cases were made into the skin of either the ear or nose, and the lesions resulting were small papules which ulcerated in most cases but which never exceeded half a centimetre in diameter and gradually disappeared in about two to three months. The animals did not appear to be inconvenienced in any way. I have been hoping to be able to test the immunity of the recovered animals against a virus of Kala-azar, but have not so far been able to obtain such a virus for experiment. It would be of the utmost interest if it were found that animals which had recovered from the benign infection were therefore immune to the more serious and fatal disease Kala-azar.

A certain number of experiments have been undertaken to test the possibility of producing a general infection by inoculating *Leishmania tropica* from Oriental

sore (both South American and Oriental) intravenously, but the results so far obtained have been inconclusive in this direction.

It may be of interest to add here that the case of South American sore which was reported by me to have recovered after treatment with an ointment consisting of equal parts of methylene blue, lanoline, and vaseline (*see* my last half-yearly report*) has had no recurrence of the disease, so that it is safe to conclude that the cure resulting is a permanent one.

In connection with the diagnosis of the skin disease Oriental sore, I am able to report two very interesting results. In one case the cat (*see* table above) which developed lesions on the ears had evidently acquired the disease, though repeated examinations of smears made from the nodules failed to reveal any leishmania. Finally the skin over one of the nodules was sterilised by means of alcoholic iodine solution and fluid drawn off from it by means of a fine glass pipette. This fluid was then inoculated into a tube of N.N.N. medium. A culture of flagellates was obtained and the diagnosis confirmed. Later, typical leishmania were discovered in smears from the lesion.

Secondly, I was able to see a case of Oriental sore owing to the kindness of Professor W. J. Simpson. This was an Englishman who had a chronic form of ulceration on the margin of the ear which had been variously diagnosed as rodent ulcer, syphilis, &c. I made films from scrapings of the sore and in addition sterilised the skin at the margin of the sore and drew off with a fine glass pipette some fluid from the edge, being careful to avoid the contaminated area of the ulcer. The fluid was inoculated into three tubes of N.N.N. medium. After three weeks' incubation a culture of flagellates was obtained in one of the tubes though a prolonged and careful examination of the smears failed to reveal a single leishmania.

These results are interesting in that it shows that in the diagnosis of the leishmaniasis a failure to find the parasites microscopically is not a proof that leishmania are not present and that the culture method is of distinct advantage as an aid to diagnosis.

A paper on this subject has just appeared in the Journal of the London School of Tropical Medicine.

II. *Trypanosoma lewisi.*

In my last report I described experiments whereby I showed that, in confirmation of Noller's results, the dog flea *Ctenocephalus canis* was a true host of *Trypanosoma lewisi*, and that infection took place not by the bite of the flea but by the rat licking up the infective fæces passed by the flea. I further showed that the human flea *Pulex irritans* could also play a similar part in the transmission. In the case of both these fleas the experiments were carried out with the fleas fixed and secured on fine wire. I have since made attempts to transmit the trypanosome by means of the human flea when liberated from the wire. To this end fleas known to be infected by an examination of the fæces were liberated from the wire and placed upon a rat. The fleas invariably disappeared and the rat did not become infected. It appeared that this flea does not like to live upon the rat. Other *Pulex irritans* uninfected were then placed upon the rat. They exhibited the utmost uneasiness and were constantly jumping off the animal. They invariably disappeared in a day or two. This being the case, it cannot often happen that the human flea in nature plays the role of transmitting host of *Trypanosoma lewisi* from rat to rat. This remark is also true, but to a less extent, for the dog flea (*Ctenocephalus canis*), which is not nearly so much at home upon the rats as are the true rat fleas, such as *Ceratophyllus fasciatus* and *Xenopsylla chœopis*, by means of both of which I have succeeded in transmitting the rat trypanosome. With the latter flea obtained from rats on Bombay ships I have demonstrated for the first time that it is a true host and carrier of this infection from rat to rat. The following experiments demonstrated this fact:—

(1) On 9th December, 1912, four *Xenopsylla chœopis* and one *Ceratophyllus fasciatus* were taken off rats infected with *Trypanosoma lewisi* and

* No.

placed upon a white rat. On 10th December, the *Ceratophyllus* and one *Xenopsylla* were removed and found to have infective forms of *T. lewisi* in their fæces. On 3rd January, the white rat was found infected with *T. lewisi*.

(2) On January 11th, two of the Xenopsylla were removed to another rat which was found infected on 22nd January.

(3) Both these fleas were again removed to a third rat on 3rd February. The rat was found infected on 14th February.

The descriptions of these experiments are given in a paper in the last number of the Journal of the London School of Tropical Medicine.

III. *Trypanosoma rhodesiense.*

The following investigation on the human trypanosome *T. rhodesiense* was undertaken in conjunction with Dr. H. M. Hänschell, the senior demonstrator at the School of Tropical Medicine. It is only fair to state that without his aid it would have been impossible to carry out the work, which has entailed a great amount of laborious counting of trypanosomes, over 160,000 of which were examined for the peculiar nuclear condition which is to be met with in this and a few other trypanosomes. The whole of the actual counting was carried out by Dr. Hänschell. The object of the investigation was to determine the constancy or otherwise of the "posterior nuclear forms" of this trypanosome in the blood of infected rats. To this end three distinct strains of the trypanosome obtained from three cases of the disease in man were examined, with the result that it was found that the special form of trypanosome not only varied in percentage in the different strains, but also in the same strain in different rats, and even in the same rat during the course of its infection. It is unnecessary to enter into a detailed description of the results here, except to state that in one strain the number varied from 0 to 0·9, in the second from 0 to 7·2, and in the third from 0 to 40·0. It is curious to note that though the maximums varied so much all strains agreed in the complete absence of such forms on certain days, though 1,000 trypanosomes were counted on each occasion. As a rule the number of posterior nuclear forms increased in percentage with the length of life of the rat, and, therefore, with the increase in the number of the trypanosomes in the rat, for these increased in number fairly regularly up to the death of the animal. It thus appears that great caution has to be exercised in judging of the presence or absence of this type of trypanosome, for it was at one time supposed that this character was peculiar to *T. rhodesiense* when it was inoculated into rats, whereas we see now that the special forms may be entirely absent on certain occasions; and, seeing that when present their numbers vary so greatly, it is conceivable that a strain might arise in which such forms never occurred or were present in numbers too small to be detected. It has been suggested that this human trypanosome *T. rhodesiense* is really none other than the *T. brucei* of Nagana disease of domestic animals. If this be so, then the name *T. rhodesiense* gives place to the name *T. brucei*. It has, however, been claimed by Blacklock and Stephens that the *T. brucei* of Uganda is not identical with the original *T. brucei* of Plimmer and Bradford from Zululand. If this is correct, then another name must be found for the Uganda trypanosome. A trypanosome occurring in domestic animals in the Sudan was described under the name of *T. pecaudi*, but it appears to be generally admitted that this is identical with the Uganda trypanosome, so the Uganda trypanosome hitherto known as *T. brucei* will have to be termed *T. pecaudi*, and if the identity of this trypansome with *T. rhodesiense* be proved then the Rhodesian human trypanosome will have to be *T. pecaudi* also. In the recent report of the Royal Society Commission, however, it is shown that a strain of *T. brucei* obtained from the same spot in Zululand where it was first discovered in 1894, corresponds so closely with *T. rhodesiense* in the presence of posterior nuclear forms and other features that the only conclusion possible is that *T. rhodesiense* is *T. brucei* in man.

A paper on this investigation has just appeared in the current number of the Journal of the London School of Tropical Medicine.

Appendix IV.

REPORTS FROM THE LONDON SCHOOL OF TROPICAL MEDICINE.

Routine Work.

Under this heading a good deal of time has been occupied in the examination of material and pathological specimens from the wards of the hospital.

In one case an individual was found to have an intestinal infection of *Tetramitus mesnili*, a flagellate which was first described by me from the human intestine. This is the second case which has occurred in the wards of the Albert Dock Hospital, but since my first description it has been met with in various parts of the tropical world.

In connection with the examination of blood special attention has been paid to the mononuclear cells and more especially to any chromatin inclusions these may have on account of the occurrence of such inclusions in cases of blackwater fever and the important significance they are supposed to have in this disease.

Several cases of amœbic dysentery have been studied and also other cases of amœbic infection which are not dysenteric, with the object of obtaining a clear insight into the nature of the amœboid organisms of the human intestine. This is a most difficult problem and involves the most careful investigation, for the subject is full of pitfalls, for any one of these organisms may assume a variety of forms under different conditions. It seems to me that insufficient attention to this point has led to the creation of a multiplicity of species of human entamœbæ.

Literary Work.

A. I have been occupied in writing reviews for the Kala-azar and Yellow Fever Sections of the Tropical Diseases Bulletin.

B. The following papers dealing with investigations in my department have appeared during the past six months :—

(1) Experiments on the Behaviour of Leishmania and Allied Flagellates in Bugs and Fleas with some Remarks on Previous Work.

(2) Experimental Amœbic Dysentery and Liver Abscess in Cats.

(3) Notes on *Trypanosoma rhodesiense* from three cases of Human Trypanosomiasis (in conjunction with Dr. H. M. Hänschell).

(4) A further note on a case of Dermal Leishmaniasis from South America, with the results of Inoculation Experiments. (Successful inoculation of a cat.)

(5) Experiments on the Transmission of *Trypanosoma lewisi* by means of Fleas.

(6) A further note on *Trypanosoma rhodesiense* from three cases of Human Trypanosomiasis (in conjunction with Dr. H. M. Hänschell).

C. M. Wenyon.

No. 2.

LONDON SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 6 November, 1913.)

Sir, Royal Albert Dock, E., 3 November, 1913.

I have the honour to enclose herewith the reports of the Special Research Departments.

During the last three sessions 45 students have taken out the course in entomology, 7 in protozoology, and 1 in helminthology.

As regards the general work of the School the number of students attending has been slightly less than last year, but the length of time during which they have been under tuition, in the aggregate, has exceeded that of any previous similar period. It is encouraging to note that in the present session there are 62 students for the ordinary course.

The past medical year has been an exceptionally interesting and important one in the annals of the Tropical School. Mr. Chamberlain's Fund, which has now reached £71,000, has enabled the School to provide additional accommodation and

to erect a new laboratory with seating accommodation for 70 students; the old laboratory has been sub-divided so as to provide a Director's laboratory, preparation room, a laboratory for the new course in Tropical Sanitation and Hygiene, and an insectorium; while the general accommodation of the School has been materially improved. Mr. Chamberlain's Fund has also enabled the School to provide much increased accommodation for students who desire to live in the School, and there are now 18 in residence.

£30,000 of this fund has already been invested for endowment. £6,000 has been invested for the maintenance of beds for the treatment of patients suffering from tropical disease, and £2,000 on account of the hostel. Mr. Chamberlain purposes closing the fund during the autumn, when the balance will be invested for endowment.

As explained in my letter of the 17th ultimo,* making application for a renewed grant from the Advisory Committee for the Tropical Diseases Research Fund, the School Committee has recommended a rearrangement of the income and expenditure. All sources of income have now been taken into one account and the expenditure spread over not only the ordinary course but the special courses and research. This rearrangement of finance has been submitted to Mr. Chamberlain and has obtained his approval. It has subsequently been submitted to the Board of Management of the Seamen's Hospital Society, who have sanctioned the course suggested.

Arrangements have been made for a new course in Tropical Sanitation and Hygiene. This will be held twice in the year—in the October and May sessions—and will consist of lectures and demonstrations on Bacteriology, Entomology, Protozoology, Helminthology, Hygiene, Chemistry, Analyses of Food and Water, Elementary Surveying, Port Health Examination, &c.

Dr. B. H. Wedd, of Guy's Hospital, has been appointed Bacteriologist and Demonstrator for this course. A circular giving further particulars is appended herewith.

I am, &c..
P. MICHELLI,
Secretary

Enclosure 1 in No. 2.

REPORT OF THE ENTOMOLOGIST FOR THE HALF-YEAR ENDING 31ST OCTOBER, 1913.

During this period I gave the usual summer courses of lectures and demonstrations in medical entomology and venomous snakes and snake-venoms. I also conducted a special course, which was attended by seven Medical Officers, in entomology from the wider standpoint of sanitation.

Much time has been taken up in rearranging and extending the index-collections of insects of pathogenic and sanitary importance, and in organising material for study. Many additions have been made to the study collections, and there are now more than 2,000 microscope preparations available for class demonstrations.

Observations and experiments have been in progress to elucidate or confirm facts in the life-history of the human flea, the cat-flea, the blue flesh-fly (*Cynomyia mortuorum*, L.), and the bed-bug. The work of some of the natural enemies of mosquito-larvæ has also been experimentally observed; not that I am disposed to over-rate the importance to the sanitarian of this line of attack; but merely to get exact specific data.

By the vacation of the old School laboratory space has been found for a properly constructed insect farm, where noxious insects can be kept and studied in their living state without danger or inconvenience to other Departments of the School. It will take some time to get this insect farm into working order, as so much depends upon opportunity; but it is hoped that it will develop into a useful appanage of the School.

The only work sent for publication is a "Synopsis of the Anopheline Mosquitoes of Africa and of the Oriental Region."

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* Not printed.

Appendix IV.

REPORTS FROM THE LONDON SCHOOL OF TROPICAL MEDICINE.

Among donors to our study collections I have much pleasure in mentioning the following gentlemen :—

Dr. H. E. Arbuckle.—Venomous snakes from Sierra Leone.

Dr. P. H. Bahr.—A large and representative collection of the mosquitoes of Ceylon, including a large number of very well preserved anopheles.

Dr. H. Bayon.—Several consignments of fleas, lice, and mites from South Africa.

Dr. R. E. Drake-Brockman.—Well-preserved material from Somaliland, including many ticks of a species that attacks man.

Dr. Copman.—Ticks (*Argas*) from East Africa.

Dr. A. Connal.—Numerous well-preserved anopheles mosquitoes from West Africa.

Dr. W. B. Johnson.—Many mosquitoes and ticks from Nigeria.

Dr. H. G. F. Spurrell.—A fine collection of flies, ticks, snakes, &c., from South America, everything being particularly desirable and choicely preserved.

Dr. A. T. Stanton.—Eggs of anopheles from Malay States.

Dr. A. R. Wellington.—A considerable collection of very useful material from the Oriental Region.

Dr. C. M. Wenyon.—Many specimens of *Phlebotomus* from Malta.

Mr. S. W. J. Scholefield.—Mosquitoes and mosquito-larvæ from East Africa.

Other donors include Dr. J. H. Harley, Dr. A. Hutton, Dr. Lamborn, Dr. R. T. Leiper, Dr. W. D. Neish, Dr. Pearson, Dr. Stones, Dr. C. Strickland, Dr. C. E. S. Watson, Dr. Yale Massey, and Dr. R. Willan.

We are also much indebted to the Entomological Research Committee for a flood of valuable material.

A. Alcock,
Lieutenant-Colonel, I.M.S.
(retired).

15th October, 1913.

Enclosure 2 in No. 2.

Report of the Helminthologist for the Half-year ended 31st October, 1913.

Helminthological Department, London School of Tropical Medicine,
17 October, 1913.

Sir,

I have the honour to present a report upon my work for the half-year ending 31st October, 1913.

Having returned from West Africa on the 28th April, I resumed my duties at the Tropical School at the commencement of the summer session on the 1st of May.

A considerable amount of material had accumulated during my six months' absence, and this occupied the earlier part of the session. During the latter half of the session the usual courses of Medical Helminthology were conducted, viz. :—(1) The ordinary course which forms part of the School certificate curriculum, (2) the advanced course in Medical Helminthology for those who have previously attended the ordinary course was attended by one student. This course is arranged to run concurrently with the ordinary course, entailing four hours of teaching daily for a period of three weeks.

The research work of the summer session has been summarised in a paper read before the Society of Tropical Medicine and recently published in its transactions. In this contribution a number of new facts are published regarding the structure, distribution, systematic position, &c., of 22 of the helminth parasites of man, and is illustrated by 36 new figures. Two new genera and a new species are created.

In material received from the wards of the Seamen's Hospital a number of specimens of *Heterophyes heterophyes* were discovered early in the vacation. This parasite has hitherto been found in man in Egypt only. The new case was a Japanese officer. A re-examination of fæces collected some time previously from a

Chinaman revealed large numbers of the same species. These observations show that *Heterophyes heterophyes* apparently has a wide range of distribution in the Far East.

A former student, Major Clayton-Lane, forwarded specimens of *Agchylostoma ceylanicum*, which had recently been found by him almost constantly in dogs and cats, and occasionally in man in Bengal. An examination of these has led me to the conclusion that the species is the same as has been previously described from cats and dogs in Brazil under the name of *Agchylostoma braziliense*. It seems probable, too, that the *A. duodenale* in dogs, described by writers in China, is this species.

The following papers have been prepared and are now at press :—

(1) *A New Cylicostome Parasite from the Horse in London.*—Published October, 1913, in the "Veterinary Journal."
(2) *Comments on two recent articles on Helminthic infections of Man.*—(In press) "British Medical Journal."
(3) *The Apparent Identity of* Agchylostoma ceylanicum *and* Agchylostoma braziliense.—To be published in the "Journal of Tropical Medicine," 1 November, 1913.
(4) *A Cysticercus with Six Suckers and Two Hookbearing Rostella.*—To be published in the "Veterinary Journal," November, 1913.
(5) *Bibliography of Bilharziosis*, by Miss V. A. Inglis and myself, to be published in the "Journal of the London School of Tropical Medicine."

Since September I have been examining, in conjunction with Surgeon Atkinson, R.N., the collection of entozoa made by the Scott Antarctic Expedition. The collection comprises Trematoda, Cestoda, Acanthocephala and Nematoda, and contains a number of interesting forms. Other collections have also been submitted, notably two series from the Gold Coast by Dr. J. J. Simpson and by Mr. Malcolm Hoyte.

The monthly reports on nematode parasites collected in the Zoological Gardens have been maintained. The accumulations of the winter months have also been reported upon.

It has been my intention in addition to the submission of monthly reports to write up this material in groups. Some progress has been made towards the realisation of this during the vacation, and at an early meeting of the Zoological Society it is proposed to present a contribution dealing with the species of the genera, Syngamus and Kalicephalus.

As sectional editor (for Helminthiasis) of the Tropical Diseases Bureau, I have had the opportunity of perusing practically all the current helminthological literature issued during the period under review, and the annotations made by me upon these have been published quarterly in the Tropical Diseases Bulletin.

I have, &c.,

Robert Thomson Leiper.

Enclosure 3 in No. 2.

Report of the Protozoologist for the Half-year ending October 31st, 1913.

The period covered by this report has included one session at the London School of Tropical Medicine, during which the usual lectures and practical classes in protozoology were given.

As soon as these were completed, at the beginning of June, I proceeded to Malta with the object of conducting observations on Oriental Sore in reference to the sand-fly *Phlebotomus*, and further to study human and canine kala-azar, which is known to exist in the island. This investigation was rendered possible by a grant received from the Honourable Edward John Stanley Memorial Fund.

My intention of feeding *Phlebotomus* on Oriental Sore was unfortunately prevented by the rapid healing of the sore soon after my arrival in Malta and the consequent loss of my supply of *Leishmania tropica*. In connection with the sand-fly, with a view to working with it, I conducted some experiments on the means most suitable for keeping it alive in captivity, and I found that a method which I had

previously used for mosquitoes gave best results. It was the outcome of an observation, made in Bagdad, that in the houses during the hottest part of the day the mosquitoes could be found resting on the cool moist outer surfaces of the large porous earthenware filters which are used for filtering and cooling the water. This principle I imitated on a smaller scale by enclosing the mosquitoes in wide-mouthed earthenware vessels like ordinary flower-pots covered with a piece of gauze tied on by tape. The vessels were placed in shallow dishes of water. In this way the mosquitoes lived in comfort in a cool moist chamber with a plentiful supply of air. For feeding purposes the flies were liberated into a mosquito-net and taken up separately in small glass tubes from which they were fed by inverting these over the skin. They were returned to the porous vessel after feeding by introducing them through a small opening made by pulling up one side of the gauze after it was tied over the mouth. This method used by me for mosquitoes in Bagdad I applied to the *Phlebotomus* in Malta. For the mosquito-net and the covering of the vessel butter muslin had to be used, for the flies would force their way through the mesh of the finest mosquito-netting. When liberated from the porous vessel in the mosquito-net (size about 7 by 7 by 7 feet) the flies invariably flew up towards the top of the net, so that there was no difficulty in taking them up in the tubes for feeding. It is well to have a small table in the net on which to place the tubes and vessel during the transferring processes. I found the flies would feed readily every second or third day. The following diary shows the best result obtained with a batch of seven flies :—

June 20. Seven females and two males were caught in the Dogs' Home. The females were fed on myself and all were confined in the porous vessel as described.

June 23. One male was dead and one escaped. All the females alive and fed again, as they did also on June 25, 27, and 29.

On July 1 one female was found crushed between the gauze and the rim of the vessel. The six females were fed, and again on July 4 and 6.

On July 9 one female was dead, but the remaining five all fed.

On July 12 four fed, but one refused food, so it was dissected. The four flies fed again on July 15, but on July 18 one was dying, so it was dissected while the three remaining flies fed. The three fed again on July 21, 24, and 27. On July 30 one had died, leaving two, both of which fed.

On August 2 there was only one left alive. This one was fed and again on August 5, but it was dead on August 8.

During the whole of this time no eggs were laid, though on dissection the flies were full of well-developed eggs. It was evident that a suitable egg-laying medium was not present. Had it been the flies might have lived even longer. One fly lived for over 46 days after its capture, so that it seems probable that in nature the length of life of *Phlebotomus* is greater than it is generally supposed to be.

Kala-azar in Malta.—This disease was first shown to exist in Malta in the infantile form by Dr. Cretien, who, in his most excellent report, pointed out that the disease had been long known under the name of " marda tal bicia," and that in the islands of Malta and Gozo during the period 1899-1908 it had been the cause of death of seven hundred and forty-four children under five years of age, and of forty-one above this age. Dr. Cretien also showed that seven of fifty-three dogs examined by him *post mortem* in April and May, 1910, were infected with leishmania and thus suffering from a disease which is presumably the same as that of children.

As regards my own observations on kala-azar in children and dogs in Malta, they are confirmatory of Dr. Cretien's results. The disease is undoubtedly common amongst children, but until some form of compulsory notification of the disease is enforced it will be impossible to have exact data. However it would appear that the diagnosis of the disease clinically in children in Malta in the absence of malaria is not attended by any great difficulty, except perhaps in its earliest stages.

But the point I would wish to emphasise is this—that, whenever the disease has been suspected clinically, it has almost invariably turned out to be kala-azar when spleen or liver puncture has been done. I saw seven suspected cases and in six of these spleen puncture was performed and leishmania discovered without difficulty. The seventh case was certainly one of kala-azar, as it was one of twins, one of which was proved by spleen puncture to have kala-azar. It thus appears that in making

returns it is safer to diagnose kala-azar if the clinical picture conforms to this disease when, for whatever reason, spleen or liver puncture cannot be done. To return such cases as splenic anemia, Banti's disease, &c., is to introduce a grave error which is infinitely greater than that which might possibly be incurred by returning all such cases as kala-azar. If all these cases were returned clinically as kala-azar, it is possible there might be included some which were not of this nature, but the error would hardly be more than one or two per cent. From the point of view of public safety it is imperative that cases of such an infectious disease be recognised, and until this is done no steps can be taken to prevent its spread. It is supposed and claimed by some that the flea is responsible for transmission of this malady. If this be so, then infected children living in crowded tenements in which fleas abound become a serious danger to other children around them.

Canine Kala-azar.—Dr. Cretien was the first to show, in Malta, as in other endemic centres of infantile kala-azar along the Mediterranean littoral that dogs suffered from kala-azar. He found that amongst stray dogs killed during April and May, 1910, as many as 14-15 per cent. suffered from the disease. During the months of June, July and August of this year I similarly examined the stray dogs killed in the Dogs' Home at Valletta. In this way I examined spleen smears of 46 dogs and found that 6 were infected, giving a percentage of 13, which is practically the same as that found by Dr. Cretien during the months of April and May, 1910. It ought to be noted, however, that the majority of the stray dogs examined were in a perfectly healthy condition and had evidently been well looked after by their owners before they had strayed. If examinations had been limited entirely to dogs which might be suspected of having the disease owing to their bad condition, then the percentages of infections would have been at least 50. Canine piroplasmosis either does not exist or is exceedingly uncommon in Malta, so that leishmaniasis would appear to be the commonest chronic affection of dogs in this island. It produces wasting alopecia, thickening of the skin, progressive weakness of the hind limbs, anæmia, &c. In almost every case before the animals were killed they were first examined by liver puncture, which is generally quite easily performed without any anæsthetic, with the help of one assistant. The operation is submitted to very well even by the largest dogs. In no single case was a diagnosis made by this means, though on one occasion a re-examination of the smear from the liver puncture material revealed a few leishmania after examination of the spleen had shown the dog to be infected. Liver puncture is thus quite unreliable for diagnostic purposes. Puncture of the spleen is difficult to perform, though once a diagnosis was made in this way without killing the animal. Bone puncture for examination of marrow would probably give good results, but such an operation could hardly be performed without an anæsthetic.

As regards the infantile and canine diseases, the most reasonable conclusion is that they are due to one and the same parasite. Therefore an infected dog (just as an infected child) should be looked upon as a danger to the community as a possible centre of infection of other children and dogs.

In connection with kala-azar in the Mediterranean districts some observers appear to think that every case of disease in a child must necessarily have taken origin in some canine case. This appears to me to be an assumption without any analogy in other diseases. A child may contract a disease from a dog, but it is just as probable, if not more so, that it has become infected from another child : and, *vice versa*, a dog may become infected from a child, but most probably from another dog. The dog and the child are both susceptible to the disease and, in consequence, both may be infected. In one family which was living alone in a house surrounded by open space and well outside Valletta two children—twins—were found to have the disease. Two dogs were kept, but these had been and were then quite healthy, and no evidence could be obtained as to their suffering from kala-azar.

Mode of spread of Kala-azar.—As dogs and children suffer from the disease, the flea which bites both dogs and men would be considered the most likely carrier. Basile, in Italy, in a series of experiments which have invariably been attended by positive results—a most unusual occurrence in such investigations—claims to have transmitted the disease to dogs by means of fleas taken off infected dogs and by fleas collected from the houses in which cases of kala-azar occurred. Again, Sergent

(Ed. and Et.), L'Heritier, and Lemaire, in Algiers fed fleas from an infected dog on an apparently uninfected dog which ultimately was found to be infected. There was, however, in this experiment a possible fallacy. Realising the importance of these experiments, I determined to carry out one in Malta, taking care to avoid all error. By employing dogs of the country there is always the possibility that the dog serving for experiment has had an unrecognised mild infection. Accordingly I had four young dogs sent out to me from England. On arriving they were removed directly to the roof of the Public Health Laboratories, where two were placed in a wire-netting cage and two were placed about 15 yards distant in a cage covered completely with muslin. In other respects as regards food, &c., their treatment was identical. Over 300 fleas were taken from a dog known to be suffering from kala-azar and liberated on the two dogs in the mosquito-proof cage. The two dogs after a few weeks began to lose flesh, and they became very anæmic. Eventually, between five and six weeks after the commencement of the experiment, both dogs died within a few days of each other. They were found to be swarming with thousands of fleas, evidently the progeny of the 300 first introduced. They were emaciated and anæmic, all the organs being very pale. The spleens were small and almost white, and in spite of long search no signs of leishmania could be found. Cultures made from the spleen and bone marrow also proved negative, so that it was clear that the dogs had not become infected. The cause of death must be attributed to the flea infection, which was enormous and which had produced the profound anæmic condition. The experiment, which was conducted with every chance of success, has thus proved negative and therefore lends no support to the flea transmission hypothesis. The two control dogs have remained perfectly healthy.

Examination of Fleas.—Several observers have claimed that fleas taken off infected dogs contain flagellates more frequently than fleas from uninfected dogs. In consequence they have assumed that the flagellates in fleas from infected dogs are in reality derived from the leishmania of the dog. In order to test the validity of this statement I carried out a long series of careful directions, with the result that I found that fleas taken off uninfected dogs were more likely to harbour flagellates than those taken off infected dogs. There is thus no evidence whatever to show that the flagellates in the fleas were derived from the leishmania of the dog, even though morphologically the flagellates might very well have been developed in this way. It is known, however, that fleas in parts of the world in which kala-azar does not occur harbour similar, if not identical flagellates, and moreover the proportion of fleas infected is approximately the same.

It has been claimed by Basile, in Italy and Sicily, that the human flea, *Pulex irritans*, is a not uncommon ecto-parasite of dogs. Of fleas collected from dogs in Malta there did not occur a single example of *Pulex irritans*. All appeared to be *Ctenocephalus canis*, the common dog flea. *Pulex irritans* is a very common pest in Malta and it is by far the commonest flea to be taken off human beings, though occasionally the dog-flea, *Ctenocephalus canis*, is found. If *Pulex irritans* feeds upon dogs it evidently does so rarely and remains only a short time upon these animals.

The following flea dissections were made :—

(1) 68 fleas from dogs which were examined for leishmania *post mortem* with negative result—only two of these fleas harboured flagellates.

(2) 206 fleas from dogs which were examined for leishmania *post mortem* with negative results—these dogs had been in a room next to an infected dog, so it was possible that some fleas had passed from the infected dog. 21 of these fleas harboured flagellates.

(3) 200 fleas from dogs proved to be infected—9 of these were proved to have flagellates.

Thus, of 274 fleas from uninfected dogs 23 were found infected with flagellates, while of 200 from infected dogs only 9 were infected.

From these figures it would certainly appear that the flagellates in the fleas were unconnected with the leishmania of the dogs.

In addition 22 *Pulex irritans* were caught off various individuals, and of these three were found to harbour flagellates.

Appendix IV.

REPORTS FROM THE LONDON SCHOOL OF TROPICAL MEDICINE.

I also carried out dissections of *Phlebotomus*, but was never able to find any flagellate infection. Previously, in Aleppo, I found that a small percentage of these flies harboured flagellates of the leptomonas type.

No indication of a flagellate infection was found in any of the 25 ticks taken off a kala-azar dog.

I have thus found no indication as to what is the carrier of kala-azar in Malta. Fleas I have been unable to incriminate, but much remains to be done in the way of experimental work, which would require a longer period than three months to carry out owing to the lengthy incubation period of the disease. The number of possible transmitting hosts in Malta is limited, and here it should be possible to conduct accurate experiments with the ample material which is there, and to continue the investigations which I have commenced during the past summer and which can only be looked upon as being of a preliminary nature.

I should like to take this opportunity of thanking all those who have assisted me in my work in Malta. Especially I would mention the staff of the Public Health Laboratories, in which I conducted my investigations. Dr. Cretien, whose past experience of kala-azar in the island was invaluable, very kindly helped me in many ways to obtain material and thus greatly facilitated my work. Professor Zammit, C.M.G., Director of the Public Health Laboratories, rendered me every assistance, and Major Morris, R.A.M.C., after his return from leave, did all he could to help me. Had he not been absent on leave during the greater part of my stay in the island I should have derived still greater benefit from him as head of the Army Sanitary Department.

C. M. Wenyon.

Enclosure 4 in No. 2.

New Course in Tropical Sanitation and Hygiene.

Arrangements have been made for a new course to be held during the October and May sessions. This will be open to students who have already attended the ordinary curriculum, and in exceptional cases Medical Officers of Health, Sanitary Officers, and others interested in preventive medicine who are not students of the School will, with the permission of the School Committee, be admitted.

The course will consist of lectures and demonstrations and will extend over two months. For those who desire it one month laboratory work, under direction, will be added to enable students who have taken the ordinary course to be signed up for six months, the period required for the Diploma in Diseases and Hygiene of the Tropics of the Conjoint Board in London. Three months' study is required for the Cambridge Diploma in Tropical Medicine and Hygiene, and one year for the London M.D. (Part VI. Tropical Medicine).

The course will comprise Bacteriology, Entomology, Helminthology, Protozoology, Hygiene, Chemical Analyses of Water and Food, Elementary Surveying, Port Health Examination, &c.

Fees for the course.—To students of the school, £1 1s. per week; to non-students, £16 16s. for the full course of eight or twelve weeks.

Further particulars may be had from the Secretary, Seamen's Hospital Society, Greenwich, London, S.E.

October, 1913.

APPENDIX V.

Reports from the Liverpool School of Tropical Medicine.

No. 1.

THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 8 May, 1913.)

SIR, B 10, Exchange Buildings, Liverpool, 6th May, 1913.

I HAVE the honour to enclose, for the information of the Tropical Diseases Advisory Committee, the following reports of the Liverpool School of Tropical Medicine for the six months ending 30th April, on the work done in connection with the Government grant, viz. :—

(1) Report of the Professor of Tropical Medicine (Professor J. W. W. Stephens).

(2) Report of the Professor of Medical Entomology (Professor Robert Newstead).

(3) Report of the Director of the Runcorn Research Laboratories of the School (Dr. Warrington Yorke).

I also enclose statement showing expenditure of the Government grant for the year ending 31st December, 1912.

The delay in sending this report has been due to the fact that the time of Professors Stephens and Newstead has been very fully occupied in preparing and setting up the exhibit of this School at the Ghent Exhibition.

I am, &c.,
A. H. MILNE,
Secretary.

Enclosure 1 in No. 1.

SIR, B 10, Exchange Buildings, Liverpool, 5th May, 1913.

I BEG to submit the following report on the work during the period from November 1st, 1912, to the 30th April, 1913.

STUDENTS.

The number of medical men who attended the Autumn Term was 12, and the number for the Lent Term 21. Total, 33. This number includes members of the Royal Army Medical Corps, Indian Medical Service, West African Medical Staff, Colonial Medical Service, &c.

DIPLOMA OF TROPICAL MEDICINE.

The number of candidates who entered for the examination was 10, of whom 9 passed. The number of candidates for the April examination was 17, of whom 16 passed.

MUSEUM.

The thanks of the School are due to the following gentlemen for their kindness in sending specimens to the School during the last six months :—

Dr. S. Bell, Hong Kong; Dr. E. P. Minett, British Guiana; Dr. Brown, Gold Coast; Dr. G. Franchini, Rome; Colonel J. R. Adie, I.M.S., Lahore; Dr. Warrington Yorke, Rhodesia; Dr. David Thomson, Panama; Professor Looss, Cairo; Dr. Henry B. Ward, Illinois, United States of America; Major Myles, Royal Army Medical Corps, Chester; Dr. H. H. Scott, Kingston, Jamaica; Dr. J. W. Scott Macfie, Northern

Nigeria; Dr. C. W. Stiles, Washington; Dr. F. H. Storey, Gold Coast; Dr. S. T. Darling, Panama; Mr. Pillers, Liverpool; Major Davidson, I.M.S., India; Dr. A. Critien, Malta; Dr. W. J. Ball Clerk, Burma; Captain P. K. Tarapore, Mandalay; Major Leonard Rogers, India; Mr. J. W. Cutmore, Liverpool; Mr. Thelwall Thomas, Liverpool; Dr. J. O. Wakelin Barrat, Liverpool; Dr. C. J. Macalister, Liverpool.

RESEARCH WORK.

Trypanosoma rhodesiense.—In conjunction with Dr. Fantham I have made further measurements of this trypanosome and of *T. gambiense.* In previous reports we have mentioned the methods used by us, and we need only repeat here that in each case a thousand trypanosomes were measured from a single animal, a white rat, taking a hundred trypanosomes each day for ten days. We believe that the curves obtained by this method are of a " better shape " than when a variety of animals is used. The result of this research has been to show that it is impossible to distinguish *T. rhodesiense* from *T. gambiense* by this method of measuring, and at present the morphological characters, as observed microscopically, and the pathogenic action are the only certain distinctive criteria.

Trypanosoma brucei (Plimmer and Bradford).—In conjunction with Dr. Blacklock I have investigated the morphology of this trypanosome. In the literature on this trypanosome we observed divergent statements as to its morphology. According to some authors this was a monomorphic species, while according to others it was dimorphic. The original Zululand strain of *T. brucei* is still maintained by us at the Liverpool School, and so far as we know here only in England. On examining this strain we found it to be a typical *monomorphic* trypanosome. We were able to obtain, through the courtesy of Dr. Plimmer, Colonel Skinner, Royal Army Medical Corps, Professor Nuttall, and Dr. Durham, old slides made from animals infected with this trypanosome, first brought to England in 1896. The trypanosomes in these slides also proved to be monomorphic. A strain of *T. brucei*, the origin of which is uncertain, was also supplied to us by Professor Laveran. This also was a typical monomorphic trypanosome. On the contrary, Bruce's old slides made in Zululand show typical *dimorphic* trypanosomes. We have discussed in our paper various possible explanations of these contradictory facts. We believe the true explanation is that the trypanosome sent to England was not the same as that in Bruce's old slides. At any rate, *T. brucei*, Plimmer and Bradford, 1899, is now monomorphic, and we believe always has been so. In the laboratory also we have another trypanosome designated *T. brucei*, which was originally derived from the ox in Uganda by Bruce and his colleagues in 1911. On examining this trypanosome we found that it was a typical *dimorphic* trypanosome, that is to say, besides the long flagellate forms there were stumpy forms in which there was no free flagellum. We next compared these two trypanosomes in a series of animals, and found that we could always distinguish certainly between the two trypanosomes; consequently we have come to the conclusion that the so-called *Trypanosoma brucei* from the Uganda ox is not the same as *Trypanosoma brucei*, Plimmer and Bradford, 1899, from Zululand, and consequently cannot be called by that name. We have proposed, therefore, in order to avoid confusion while its identity is being further investigated for this trypanosome of the Uganda ox the name *Trypanosoma ugandæ.*

Recent research has shown that posterior nuclear forms exist not only in *Trypanosoma rhodesiense*, but also in the trypanosome from the Uganda ox (*T. ugandæ*), and in other trypanosomes, and it is possible that these trypanosomes with posterior nuclei are closely allied to one another, although it does not follow that they are identical. At any rate, one can conclude from this research that *Trypanosoma rhodesiense* is quite a different trypanosome from *T. brucei*, Plimmer and Bradford. As to the relationship of *Trypanosoma rhodesiense*, *T. ugandæ* and other trypanosomes with posterior nuclei, further research is required. Regarding the relationship of *T. Brucei*, Plimmer and Bradford, the question arises whether it may not be related to, or identical with, *T. evansi* (Surra), but on this point also further research will be necessary.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

Publications.

(1) Stephens, J. W. W. and Fantham H.B. Further Measurements of *Trypanosoma rhodesiense* and *T. gambiense*. Annals of Trop. Med. and Parasit. Vol. VII., No. 1.

(2) Stephens, J. W. W. and Blacklock, B. On the Non-Identity of *Trypanosoma brucei*, Plimmer and Bradford, 1899, with the Trypanosome of the Same Name from the Uganda Ox. Proc. Roy. Soc. B. Vol. 86, 1913, pp. 187-191.

I am, &c.,
J. W. W. Stephens.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings, Liverpool.

Enclosure 2 in No. 1.

Department of Medical and General
Economic Entomology,
B 10, Exchange Buildings, Liverpool, 6th May, 1913.

Sir,

I have the honour to submit herewith a report for the half-year ending April 30th, 1913.

1. The usual courses of instruction were given to the students attending this School for the Diploma in Tropical Medicine. The number of students attending the courses were :—

For the Autumn Term	12
For the Lent Term	21

2. For the Special Course in Medical and Economic Entomology for Colonial officers and others, there were present :—

For the Autumn Term	6
For the Lent Term	5

3. A course of lectures and demonstrations has also been given to the undergraduates and postgraduates in the Veterinary Department of the University.

4. One advanced student has devoted considerable time to the study of African blood-sucking insects, especially of the families Culicidæ, Tabanidæ, and Muscidæ.

Reports and Publications.

1. On the Characteristics of the newly-discovered Tsetse-fly, *Glossina austeni*, Newstead; with descriptions of the genital armature of *Glossina fuscipleuris*, Austen, and *Glossina longipennis*, Corti. Bulletin of Entomological Research, Vol. III., part 4, pp. 355-360. Figs. 1-3 (1912).

2. Notes on Phlebotomus, with descriptions of new species. Part I. Bulletin of Entomological Research, Vol. III., pt. 4, pp. 361-367, figs. 1-3 (1912).

3. On a Remarkable Gall-producing Psyllid from Syria (Joint with Mr. Bruce F. Cummings). Annals and Magazine of Natural History, Series 8. Vol. XI., figs. 1-5. March, 1913.

4. A new Tsetse-fly from the Congo Free State, and the occurrence of *Glossina austeni*, Newstead, in German East Africa. Annals of Tropical Medicine and Parasitology, Vol. VII., No. 2, pp. 331-334, figs. 1-2 (1913).

The following Papers have been published by the Assistant Entomologist, Mr. H. F. Carter:—

1. Descriptions of Three New African species of the Genus *Tabanus*. Annals of Tropical Medicine and Parasitology. Vol. VI., No. 4, pp. 435-442. Pl. XXIII., figs. 1-9 (1912).

2. External Myiasis in a Monkey (Joint with Dr. Blacklock). British Medical Journal. January, 1913.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

Additions to the Museum Collections.

We wish to express our sincere thanks to the following gentlemen who have been pleased to present to us collections of blood-sucking insects, ticks, &c., for demonstrative and other purposes :—

Dr. J. H. Ashworth, Edinburgh. Ticks.
Dr. L. Bostock, Portuguese East Africa. Ticks.
Dr. F. F. Brown, Ashanti. Various blood-sucking insects, &c.
Captain F. W. Cragg, I.M.S. Muscidæ.
Dr. J. W. B. Hanington, Nigeria. Tabanidæ.
Dr. C. Hardwicke, Mexico. Ticks.
Dr. Slater Jackson, Amazon. Tabanidæ, &c.
Drs. Allan Kinghorn and W. Yorke, Rhodesia. Tabanidæ, Muscidæ, Ixodidæ.
Major E. L. Perry, India. Extensive series of Anopheline mosquitoes.
Mr. A. W. W. Pillers, Liverpool. Acarids.
Mr. Beale Pinyon, Kent. Ticks.
Dr. Harald Seidelin, Mexico. Mosquitoes, etc.
Dr. H. Wolferstan Thomas, Manaos. Culicidæ, &c.

In addition to the foregoing we also tender our sincere thanks to the Imperial Bureau of Entomology, *per* the Scientific Secretary, Mr. Guy A. K. Marshall, for the valuable gift of an extensive collection of blood-sucking insects and ticks numbering in all 148 species, 1,926 specimens.

Identification of Blood-sucking Insects, Agricultural Pests, &c.

The following is a summary of the number of species and specimens identified by myself and my assistant, Mr. H. F. Carter, during the past six months. These include collections from the Congo Free State and other parts of Africa, South and Central America, West Indies, India, and the British Isles :—

——	Species.	Varieties.	Specimens.
Mosquitoes (Culicidæ)	41	1	995
Papataci Flies (Phlebotomus)	3	1	83
Horse Flies, &c. (Tabanidæ)	37	2	218
Tsetse-Flies (Glossina spp.)	14	2	1,675
Stomoxydinæ	6	—	42
Hippoboscids	3	—	11
Scale Insects (Coccidæ)	99	—	* Indefinite.
Aleurodidæ	1	—	,,
Aphidæ	2	—	,,
Psyllidæ	1	—	,,
General Economic	16	—	,,
Ixodoidæ	5	—	206
Total	228	6	3,230

* The total number of specimens examined cannot be given with any degree of accuracy owing to their minute size.

I have, &c.,
Robt. Newstead,
Professor of Medical and Economic Entomology.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings, Liverpool.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

Enclosure 3 in No. 1.

Runcorn Research Laboratories, Runcorn,
30th April, 1913.

Sir,

I have to submit the following report on work done in the Runcorn Research Laboratories of the Liverpool School of Tropical Medicine from November 1st, 1912, to April 30th, 1913.

The grant has been expended on the upkeep of the Laboratory and on the purchase of animals necessary for the preservation of the various pathogenic protozoa required for research and teaching purposes. The number of parasites maintained here has been increased of late, so that at the present time we have, in addition to *Piroplasma canis* and *Spirochæta duttoni*, fifteen different pathogenic trypanosomes, including *T. gambiense*, *T. rhodesiense* (two strains), *T. brucei*, *T. ugandæ*, *T. equiperdum* (three strains), *T. evansi*, *T. equinum*, *T. dimorphon* (two strains), *T. pecorum*, *T. vivax*, and *Schizo-trypanonum cruzi*.

I returned to England in November last upon the completion of my work in connection with the British South Africa Sleeping Sickness Commission. Dr. Blacklock, who was in charge of the laboratory during my absence in Africa, was in January granted three months' leave of absence for the purpose of study in Germany; he has since returned to the laboratory.

Much of my time during the past six months has been occupied in finishing off the final report of the work done by the British South Africa Sleeping Sickness Commission. This report, which occupies about 120 pages of the Annals of Tropical Medicine and Parasitology, is divided into the following six sections :—

Section 1 deals with the human trypanosome of Rhodesia. The identity of the parasite with *T. rhodesiense*, its transmission by *Glossina morsitans*, both in the laboratory and in nature, the influence of meteorological conditions on the development of the trypanosome in the fly, and the natural reservoir of the trypanosome are discussed.

Section 2 records the results of examination of game and domestic stock for pathogenic trypanosomes.

Section 3 deals with the pathogenic trypanosomes which are transmitted in nature by *Glossina morsitans*.

Section 4 gives a description of the various trypanosomes encountered.

Section 5 discusses the development of *T. rhodesiense* in *Glossina morsitans*.

Section 6 is the report of the Entomologist attached to the Commission, and deals with *Glossina morsitans* in the laboratory, the pupal habitats of *Glossina morsitans*, and the blood-sucking insects collected in Northern Rhodesia.

There is also an appendix describing experiments devised to ascertain whether Tabanids and *Ornithodoros moubata* can transmit trypanosomes.

In conjunction with Professor J. W. W. Stephens, Dr. B. Blacklock has been engaged upon the study of the morphology of two strains of *T. brucei*. The strains in question are *T. brucei*, Zululand, 1894, and *T. brucei*, Uganda, 1909. Hitherto these strains have been considered identical. Stephens and Blacklock, however, have brought forward evidence to show that they are not identical, *T. brucei*, Zululand, being a monomorphic trypanosome, whereas *T. brucei*, Uganda, is typically dimorphic. They consider the Uganda parasite to be a different species from the Zululand trypanosome, and propose for it the name *T. ugandæ*.

Mr. Carter and Dr. Blacklock have made some observations upon external myiasis in a monkey. Larvæ found upon the skin of a monkey at Runcorn proved to be those of *Fannia canicularis* and *Muscina stabulans*. Dr. Blacklock has also made a study of the trypanosome causing sleeping sickness in Rhodesia with special reference to the occurrence in this strain of the posterior nuclear forms which have, up to the present, served to distinguish it morphologically from the original *T. gambiense* (Dutton).

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

Jointly with Dr. J. O. Wakelin Barratt, Director of the Cancer Research Laboratory, University of Liverpool, I have conducted experiments on the subject of hæmoglobinæmia, and on the relationship of hæmoglobin to the bile pigments. This research has been carried out with a view to elucidating certain obscure points in connection with blackwater fever, and forms a continuation of our previous communications on this subject. An account of this work will shortly be ready for publication.

In March I read a paper at the Zoological Society of London on the relationship of big game in Africa to the spread of sleeping sickness. In this paper I referred to the fact that Dr. Kinghorn and I had found that at Nawalia, in the Luangwa Valley, 50 per cent., and at Ngoa, on the Congo-Zambesi watershed, 35 per cent. of the big game were infected with trypanosomes pathogenic to man or domestic stock. The proportion of game infected with *T. rhodesiense* was at Nawalia 16 per cent. and at Ngoa 3·3 per cent. In view of these facts I advocated the advisability of removing all restrictions relating to the killing of game by Europeans and natives in " fly " areas, especially in those portions of such areas which were in the vicinity of human habitations, and further suggested the desirability of a thoroughly scientific experiment devised with the object of ascertaining the results of eradicating the game in a certain limited district being undertaken somewhat along the following lines :—

A locality which is fairly well populated, and which contains plenty of tsetse flies and game, should be chosen. An exact census of the population should be made, and the proportion suffering from sleeping sickness determined. The same must be done in the case of domestic animals if such exist. An index of the percentage of infective tsetse flies must be ascertained; this is most important, as it gives definite information of the potential danger of the district. Finally, the game should be completely eradicated, and at the same time the percentage infected with human and cattle trypanosomes determined, and when once the game has been driven out it must be kept back by vigorous action, and not allowed to return. After an interval of a couple of years or so the population, domestic stock, and tsetse fly must again be examined. Then we should be in a position to decide definitely whether or not driving the fauna back from the vicinity of human habitations in " fly " areas would be justifiable. These proposals evoked considerable opposition; the paper, criticisms, and my reply are to be published in the June number of the proceedings of the Zoological Society.

The following papers have been published during the past six months :—

B. Blacklock. A Study of the Posterior Nuclear Forms of *Trypanosoma rhodesiense* (Stephens and Fantham) in Rats. Annals of Tropical Medicine and Parasitology. Vol. 7. No. 1, 1913.

J. W. W. Stephens and B. Blacklock. On the non-Identity of *Trypanosoma brucei* (Plimmer and Bradford, 1899), with the Trypanosome of the same name from the Uganda Ox. Proc. Royal Soc., B. Vol. 86, 1913.

H. F. Carter and B. Blacklock. External Myiasis in a Monkey. British Medical Journal. January 11th, 1913.

A. Kinghorn, W. Yorke, and H. Lloyd. Final Report of the British South Africa Sleeping Sickness Commission. Annals of Tropical Medicine and Parasitology. Vol. VII., No. 2, 1913.

I am, &c.,
WARRINGTON YORKE,
Director of the Runcorn Research Laboratories.

The Secretary,
The Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings, Liverpool.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

Enclosure 4 in No. 1.

An Account showing the Disposal of the Government Grant for the Year ending 31st December, 1912.

Dr.	£	Cr.	£
To Grant to special work on trypanosomiasis towards purchase of animals and upkeep of same, attendants' wages, instruments, chemicals, &c.	250	By Grant from the Tropical Diseases Research Fund ...	1,000
To proportion of salaries of workers on trypanosomiasis at the Runcorn Laboratories	250		
To proportion of salary of the Lecturer in Tropical Medicine January to December at £62 10s. per quarter ...	250		
To proportion of salary of the Lecturer in Economic Entomology and Parasitology, January to December, at £62 10s. per quarter ...	250		
	£1,000		£1,000

Examined and compared with the books and vouchers and found correct.

Chalmers, Wade, and Co.,
Auditors to the Liverpool School
of Tropical Medicine.

Liverpool,
7 May, 1913.

No. 2.

LIVERPOOL SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 1 November, 1913.)

B 10, Exchange Buildings, Liverpool,
31st October, 1913.

Sir,

I have the honour to enclose, for the information of the Tropical Diseases Advisory Committee, the following reports of the Liverpool School of Tropical Medicine for the six months ending 31st October, showing the manner in which the Government Grant to the School has been expended, viz. :—

(1) Report of the Professor of Tropical Medicine of the School (Professor J. W. W. Stephens).

(2) Report of the Director of the Runcorn Research Laboratories of the School (Dr. Warrington Yorke).

(3) Report of the Professor of Medical Entomology (Professor Robert Newstead).

(4) Report of the Lecturer in Parasitology (Dr. H. B. Fantham).

(5) Report by Dr. David Thomson, Research Worker on Malaria.

I am, &c.,
A. H. MILNE,
Secretary

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

Enclosure 1 in No. 2.

B 10, Exchange Buildings, Liverpool,
31st October, 1913.

Sir,

I beg to submit the following report on the work done during the period from May 1st to October 31st, 1913.

Students.—The number of admissions for the Autumn Course is 19. During the month of June, two Sanitary Inspectors attended a special course of instruction in entomology, protozoology, and practical sanitation. One student attended a special course in protozoology.

Museum.—The thanks of the School are due to the following gentlemen for their kindness in sending specimens to the School during the last six months :—

Dr. C. J. Macalister, Liverpool; Professor Ferguson, Cairo; Dr. A. J. Chalmers, Ceylon; Dr. S. Bell, Hong Kong; Dr. W. E. Haigh, Adrianople; Dr. H. S. Stannus, Nyasaland; Major Hooton, I.M.S., India; Dr. Scott Macfie, Yaba, Lagos; Dr. H. H. Scott, Kingston, Jamaica; Dr. D. E. Anderson, Trinidad; Dr. H. B. Fantham, Khartoum Expedition; Dr. M. Ricono, Cape Province; Major Myles, R.A.M.C., Chester; Dr. Abrassart, Leverville, Congo Free State; Dr. Wm. Rogers, Barry Docks; Dr. J. G. Thomson, Liverpool; Major J. Davidson, I.M.S., Dehra Dun, India; Mr. N. Pillers, M.R.C.V.S., Liverpool; Captain W. S. Patton, I.M.S., Guindy, Madras; Dr. H. Wolferstan Thomas, Manaos, Brazil.

Publications.—The following is a summary of the papers contributed during the half-year by the staff of the School. They are referred to in detail in the various reports appended :—

Stephens, J. W. W. and Blacklock, B. On the Non-identity of *Trypanosoma brucei* (Plimmer and Bradford, 1899) with the Trypanosome of the same name from the Uganda Ox. Annals. Trop. Med. and Parasitol. Vol. VII., No. 2. June 1913.

Newstead, R. A New Tsetse-Fly from the Congo Free State, and the occurrence of *Glossina austeni* in German East Africa. Annals Trop. Med. and Parasitol. Vol. VII. No. 2. June 1913.

Notes on Scale Insects (Coccidæ), Part I. Bull. Ent. Res. Vol. IV., pp. 67-81, figs 1-11. May 1913.

Fantham, H. B. Further Measurements of *Trypanosoma rhodesiense* and *T. gambiense.* Annals Trop. Med. and Parasitol., VII., pp. 27-39. (With Prof. Stephens.)

Note on the Specific Name of the Herpetomonas found in the Dog Flea, *Ctenocephalus canis.* Bull. Soc. Pathologie Exotique, VI., pp. 254-255.

Sarcocystis colii, n. sp., a Sarcosporidian occurring in the red-faced African mouse-bird, *Colius erythromelon.* Proc. Cambridge Philosoph. Soc., XVII., pp. 221-224, with 1 plate.

The "Isle of Wight" Bee Disease (Microsporidiosis) Second Report. Supplement to Journ. Bd. Agriculture, July 1913.

Thomson, D. Sanitation in the Tropics with special reference to the Panama Canal Zone, Trinidad, and British Guiana. Trans. Soc. Trop. Med. and Hyg., May 1913. Vol. VI. No. 6, pp. 183-209.

The Growth and Sporulation of the Benign and Malignant Tertian Malarial Parasite in the Culture Tube and in the Human Host. Proc. Roy. Soc. B. Vol. 87. June 1913. (With J. G. Thomson.)

Preliminary Note on Leprosy and the Bed-bug. Brit. Med. Journ. Oct. 4, 1913, p. 849.

Yorke, Warrington. The Relationship of the Big Game of Africa to the Spread of Sleeping Sickness. Proc. Zool. Soc. of London. June 1913.

Sleeping Sickness and Big Game. Brit. Med. Journ. June 21st, 1913.

The Relation of Big Game to Sleeping Sickness. Journal of the African Society. Oct. 1913.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

Blacklock, B. and Yorke, W. The trypanosomes causing Dourine (Mal de Coït or Beschälseuche). Proc. Roy. Soc. B. Vol. 87, pp. 89-96. 1 plate.

Ghent Exhibition.—Four cases illustrating, respectively, the following diseases, viz., ankylostomiasis, malaria, sleeping sickness, and yellow fever, were prepared at the request of the Board of Trade for the British section of the Exhibition. The preparation of these cases involved much labour during the first six months of the year.

I have, &c.,
J. W. W. Stephens,
Professor of Tropical Medicine.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings.

Enclosure 2 in No. 2.

B 10, Exchange Buildings, Liverpool,
30th October, 1913.

Sir,

I have to submit the following report on the work done in the Runcorn Research Laboratory of the School from May 1st to October 30th, 1913.

As usual, the grant has been expended on the upkeep of the laboratory, and on the purchase and maintenance of the experimental animals necessary for the preservation of the various pathogenic protozoa required for research and teaching purposes.

Dr. Blacklock and I have spent much time during the last six months examining the efficacy of stibium trioxide (Trixidin) as a remedy for trypanosomiasis. In May last a series of papers were published by Professor Kolle and others calling attention to the value of this drug. Unfortunately, our results do not entirely confirm the optimistic statement of Kolle and his collaborators. Whilst the drug appears to cure a proportion of smaller laboratory animals infected with certain trypanosomal strains, yet it is without action in the case of certain other strains. Apparently a number of goats infected with *T. vivax* were successfully treated with the drug, but we were unable to cure infected donkeys. A paper incorporating the results of this work is in preparation.

We have also examined the morphology of the trypanosomes causing dourine (Mal de Coït or Beschälseuche), and find that there are at the present time at least two morphologically distinct trypanosomes, which have been obtained from dourine horses, maintained in the European laboratories.

I have written various papers dealing with the relationship of the African fauna to the spread of sleeping sickness, setting forth the arguments in favour of a definite scientific experiment being undertaken with a view to ascertaining the result, on the infectivity of *G. morsitans*, and on the occurrence of the fly itself, of exterminating all game animals in a limited fly area, such as the Sebungwe District of Southern Rhodesia.

In conjunction with Dr. Blacklock I have written a paper dealing with the classification and identification of the more important mammalian trypanosomes. In this paper we have endeavoured to separate the points which are essential and practical from those which are merely theoretical and doubtful, and to indicate in a precise manner the characters which should be considered in attempting to assign a trypanosome to its proper position. A table is attached in which, making use of the principles laid down in our paper, we have given what we consider to be the salient characters of the more important mammalian trypanosomes.

We have succeeded in making a strain of *T. vivax* pathogenic for rabbits. This work is of interest as indicating the manner in which trypanosomes may be altered by artificial maintenance in the laboratory by passage from one animal to another by inoculation.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

The following is a list of the papers published from the laboratory since May 1st, 1913 :—

(1) Yorke, Warrington. The Relationship of the Big Game of Africa to the Spread of Sleeping Sickness. Proc. Zool. Soc. of London. June, 1913.
(2) Yorke, Warrington. Sleeping Sickness and Big Game. B.M.J., June 21st, 1913.
(3) Blacklock, B. and Yorke, W. The Trypansomes causing Dourine (Mal de Coït or Beschälseuche). Roy. Soc. Proc., 1913. Vol. 87, p. 89.
(4) Yorke, Warrington. The Relation of Big Game to Sleeping Sickness. Journal of the African Society, October, 1913.
(5) Blacklock, B. and Yorke, W. *Trypanosoma vivax* in Rabbits. Annals of Tropical Medicine and Parasitology, 1913. Vol. VII. No. 4.
(6) Yorke, W. and Blacklock, B. The Differentiation of the more important Mammalian Trypanosome. Annals of Tropical Medicine and Parasitology, 1913. Vol. VII. No. 4.

The following papers are awaiting publication :—

(7) Barratt, J. O. W. and Yorke, W. The Symptoms attending Hæmoglobinæmia.
(8) Barratt, J. O. W. and Yorke, W. The Relation of the Bile Pigments to Hæmoglobin.

I am, &c.,
Warrington Yorke.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings, Liverpool.

Enclosure 3 in No. 2.

Department of Medical and General Economic Entomology.

Sir, B 10, Exchange Buildings, Liverpool, 31st October, 1913.

I have the honour to submit the following report for the half-year ending October 31st, 1913.

1. *Students.*—The usual courses of instruction were given to the students attending this School for the Diploma in Tropical Medicine. The number of students attending the course were :—

For the Summer Term (Short Course)	3
For the Autumn Term (Full Course)	19

2. For the Special Course in Medical and Economic Entomology for Colonial Officers and others, there were present :—

Summer Term (June, 1913)	4

3. A course of lectures and demonstrations has also been given to the undergraduates and post-graduates in the Veterinary Department of the University.

4. One advanced student devoted considerable time to the study of African blood-sucking insects, especially of the families Culicidæ, Tabanidæ, and Muscidæ.

Identification of blood-sucking insects, agricultural pests, &c.—Mr. H. F. Carter and myself have devoted considerable time, chiefly during the long vacation, to the identification of insects affecting man and his cultivated crops, &c. The material was sent from various parts of the world, viz., the Congo Free State, German East Africa, Portuguese East Africa, Uganda, the Transvaal, and other parts of Africa; the West Indies, British Guiana, Cyprus, Turkey, Albania, &c.

This work has involved the preparation of several hundred specimens for microscopical examination, a large number of which were returned to the institutions from which the material was sent; among these the following are the chief :— Imperial Bureau of Entomology (Colonial Office); Musée Royal d'Histoire Naturelle, Belgique; Musée du Congo Belge, Tervueren; Konigl. Zoologisches Museum, Berlin; Department of Agriculture, Cairo, Egypt.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

Collectively these insects give a grand total of 4,047 specimens, representing 228 species.

A tabulated statement is appended below :—

	Species.	Varieties.	Specimens.
Mosquitoes (Culicidæ) ...	39	—	422
Papataci flies (Phlebotomus) ...	2	1	4
Midges (Culicoides)	3	—	36
Horse flies (Tabanidæ)	27	1	233
Tsetse-flies (Glossina) ...	12	2	1,944
Muscidæ other than Glossina ...	3	—	5
Hippoboscidæ	2	—	19
Mallophaga, &c. (Lice) ...	2	—	100
Scale Insects (Coccidæ) ...	124	—	*1,240
Plant Lice (Aphidæ)	1	—	3
General	8	—	indefinite
Ticks (Ixodoidæ)	5	—	41
	228	4	4,047

*Microscopical preparations only counted.

Publications.—1. Notes on Scale Insects (Coccidæ) Part I. Bull. Ent. Res. Vol. IV., pp. 67-81, figs. 1-11. May, 1913.

2. A new tsetse-fly from the Congo Free State, and the occurrence of *Glossina austeni* in German East Africa. Annals Trop. Med. and Parasitol. Vol. VII., pp. 331-334, 2 figs. June, 1913.

Ghent Exhibition.—Professor J. W. W. Stephens has reported on our joint work in connection with the preparation of specimens, drawings, &c., for the British Section of the Ghent Exhibition.

I have, &c.,
ROBERT NEWSTEAD,
Professor of Medical and Economic Entomology.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings, Liverpool.

Enclosure 4 in No. 2.

SIR, B 10, Exchange Buildings, Liverpool, 31st October, 1913.

I BEG to submit the following report on my work during the period from May 1st to October 31st, 1913.

My time has been fully occupied with teaching and with research. The researches have been conducted in Liverpool, and on the scientific expedition which I made to Khartoum, extending from June through the summer vacation to the end of September, 1913. The journey was undertaken at the invitation of the Government of the Anglo-Egyptian Sudan. In addition to research work at Khartoum, I made a collection of preparations showing various protozoa, worms, mycological specimens, lantern slides, and photographs for museum and teaching purposes.

The details of my work may be summarised as follows :—

Teaching.—In June I conducted the short course in protozoology and helminthology for post-graduate students. The course included lectures and demonstrations on the principal groups of the parasitic protozoa and worms. One student did more advanced work in protozoology.

On my return from Khartoum I began lecturing and demonstrating on protozoology to the students working for the Diploma of Tropical Medicine. Lectures and demonstrations on helminthology will follow.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

Several research workers have been engaged on investigations in the School, and it has been my privilege to be of service to them in their work. I was able, also, to be of service to former students of the School, now in the Colonies, in advising them as to literature, examining specimens sent by them, and aiding in the preparation of papers and illustrations.

Research work.—Investigations have been begun or continued on the spirochaetes affecting the vascular and respiratory systems of man, various pathogenic trypanosomes of man and of transport animals, and on various parasites of birds, fish, and insects. I am at present preparing a report on some of these investigations.

Work has been continued on a disease of bees due to *Nosema apis*, and popularly called " Isle of Wight Disease," for the Board of Agriculture.

The scope of some of these researches is indicated in the appended list of publications.

Editorial and Literary Work.—I have continued to act as Associate Editor and Editorial Secretary of the Annals of Tropical Medicine and Parasitology, of which two numbers have appeared during 1913, and a third is now ready for immediate issue.

I have also reviewed much literature relating to parasitic protozoa for the Bulletin of the Tropical Diseases Bureau, of which I am Sectional Editor for the protozoa.

Publications.—1. " Further Measurements of *Trypanosoma rhodesiense* and *T. gambiense* " (With Prof. Stephens). Annals Trop. Med. and Parasitol., VII., pp. 27-39.

2. " Note on the Specific Name of the Herpetomonas found in the Dog Flea, *Ctenocephalus canis.*" Bull. Soc. Pathologie Exotique, VI., pp. 254-255.

3. " *Sarcocystis colii*, n. sp., a Sarcosporidian occurring in the red-faced African mouse-bird, *Colius erythromelon.*" Proc. Cambridge Philosoph. Soc., XVII., pp. 221-224, with 1 plate.

4. The " Isle of Wight " Bee Disease (Microsporidiosis). Second Report. Supplement to Journ. Bd. Agriculture, July, 1913.

I have, &c.,
H. B. Fantham,
Lecturer in Parasitology.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B 10, Exchange Buildings, Liverpool.

Enclosure 5 in No. 2.

Report by Dr. D. Thomson on Research at the Liverpool School of Tropical Medicine.

In September, 1912, Dr. D. Thomson was sent to the American Canal Zone, Panama, also to Trinidad and British Guiana, to observe the state of sanitation in these countries. A full report of his observations is published in the " Annals of Tropical Medicine and Parasitology," Vol. VII., No. 1 (" Sanitation in the Tropics with special reference to the Panama Canal Zone, Trinidad, and British Guiana ").

During his stay in Panama, Dr. Thomson did some further research on the development of crescents. This work is not yet published. He also did a considerable amount of work in Liverpool, Panama, and Trinidad, regarding the transmission of leprosy by bed-bugs. A total of 105 bed-bugs fed on lepers, and 35 caught in the beds of lepers, were carefully examined, but no evidence was obtained to show that these insects harbour or transmit the disease. A further total of 107 bed-bugs were examined as controls; 21 of these were caught in dwellings in Liverpool, and

the remainder in the Spanish wards in Ancon Hospital, Panama. The controls also gave negative results. The full details of this investigation will be published in the Annals of Tropical Medicine and Parasitology. A preliminary report on the subject was published in the British Medical Journal, October 4, 1913.

Since his return from Panama in February, 1913, Dr. D. Thomson has been engaged with Dr. J. G. Thomson on the cultivation of malarial parasites in vitro. This work has resulted in the elucidation of certain obscure points regarding malignant tertian malaria. The full details of this work will be published in the Proceedings of the Royal Society and in the Annals of Tropical Medicine and Parasitology. An article on " The Cultivation of One Generation of Benign Tertian Malaria " has already been published in the Annals of Tropical Medicine and Parasitology, Vol. VII., No. 1 (March, 1913).

APPENDIX VI.

Reports on Work done in Colonial Laboratories.

No. 1.

BRITISH GUIANA.

THE GOVERNOR to THE SECRETARY OF STATE

(Received 21 January, 1913.)

Government House, Georgetown, Demerara,
31st December, 1912.

SIR,

I HAVE the honour to transmit a report on tropical diseases research work in the British Guiana Laboratory during the half year ended 30th September, 1912.

I have, &c.,
WALTER EGERTON.

Enclosure in No. 1.

REPORT OF TROPICAL DISEASES RESEARCH IN THE GOVERNMENT BACTERIOLOGICAL LABORATORY, BRITISH GUIANA, FOR THE SIX MONTHS APRIL, 1912, TO SEPTEMBER, 1912, BY K. S. WISE, GOVERNMENT BACTERIOLOGIST, AND E. P. MINETT, ASSISTANT GOVERNMENT BACTERIOLOGIST.

1. *Aspergillar mycosis.*
2. *Septicemia* and the *Filaria Bancroftii.*

Aspergillar mycosis.

In March, 1912, there was admitted to the Public Hospital, Georgetown, British Guiana, a woman, 55 years of age, and of black race (negro). She was then in a moribund, semi-conscious condition, and died a few hours after admission. The clinical facts ascertained were that the temperature was 103°, and that fever had lasted " some time." Breathing was laboured; dullness was found in the lungs and œdema in the legs; the diagnosis made was lobar pneumonia.

The post-mortem examination two hours later showed œdema of both legs, a few old, fibrous pleuritic adhesions in both pleuræ. In general both lungs were affected by chronic bronchitis. At the base of the right lung was an area of consolidation 5 by 4 by 3 inches in size. This consolidated area on section projected above the surrounding surface; it had a honeycombed appearance; was dry to the touch and felt hard, creaky, and friable. The heart and spleen were natural, and showed no gross microscopic lesion. Both kidneys contained numerous small cysts all over the substance; the cortex was of customary breadth, and the capsule stripped readily. The intestines were natural; the liver was affected with early cirrhotic changes. A cursory examination of the pneumonic area demonstrated large quantities of a mycelium, and death was, therefore, ascribed to pneumomycosis, the precise nature of the mycelial growth being unknown. Cultures were readily obtained of a black fungus growth almost in pure culture. This was sent to Professor Foulerton, in London, who was kind enough to report as follows :—" I am able to say with certainty that the parasite is *Aspergillus fumigatus.*"

This parasitic mould grows readily on all ordinary media. On agar the growth forms white mycelial growth which (at 37° C.) acquires a blackening all over, due to the formation of conidiophores. Later, the whole growth becomes a black mass of conidiophores. Thus, in the earlier stages, there is white mycelium only, which becomes obscured by a profuse black fructification. The filaments of mycelium are 2 to 3μ broad. The conidiophore is short, being about 5μ, ending in a club-shaped mass on which are 20-25 sterigmata 5μ long. These sterigmata are bunched close

together, and at first sight resemble the characteristic arrangement of penicillium. A chain of conidia springs from each sterigma slightly oval, 2 to 3μ diameter.

The conidia, sterigmata, and club-shaped mass are first light coloured, but at maturity take on a full black colour.

The optimum temperature of growth is 37° C., but it grows readily at room temperature (27° C.). On alkaline media the growth is usually black; on acid media a greenish tint is recognisable. Cultures are killed by a temperature of 70° C. for ten minutes. The spores are resistant, and cultures are readily subcultured after nine months on dry agar. No fluorescence is produced in neutral red, which is taken into the mycelium and colours it. Growth occurs readily in peptone sugar media with the formation of acid, save in glycerine and salicin; milk also is turned acid. Spores placed in dry earth in a flask were recovered alive five months later. French authors have found the spores of this fungus germinate after four years; they state that these spores resist several weeks in putrefying masses, and are capable of growing after passing through the alimentary canal.

Pathology.—Microscopical sections of the lung showed that the process of inflammation was apparently slowly spreading and chronic. The mycelium was greatly in evidence, some areas being completely filled with mycelium. It was septate and branching, but no fructification was seen. The lung tissue and alveoli in and around the mycelial areas was necrotic. Outside the area of mycelial growth and necrosis was a casing of fibro-blastic tissue, in some places reaching the stage of fully-formed fibrous tissue. In other places the productive elements were few, and merged into a band of leucocytic infiltration. Comparatively few of these were polymorphonuclear, the majority being mononucleated; some were undoubted plasma cells. The area of lung tissue around was collapsed and congested in many cases; hæmorrhage had occurred into the alveoli.

It would appear as though the action of the parasite was two-fold: partly that of pressure causing the alveoli of the immediate vicinity to close, and partly a toxic effect leading to the necrosis of adjacent tissues. Experiments carried out on rabbits and guinea-pigs showed that subcutaneous and intraperitoneal injections failed to produce pathogenic results. Intravenous injections by the ear of the sporulating state produced necrotic areas in the lung and liver. These were not the result of infarts, but definite growths of a mycelium penetrating the whole necrotic area. The kidney and spleen showed no changes.

As regards the etiology and mode of infection, Professor Foulerton writes as follows :—" Infection for man has been traced to the chewing of uncooked grain and in flour " ; also " lower animals probably become infected from herbage of one kind or another."

" The infection is, I feel certain, uncommon in this country (England), and this may possibly have some relationship to temperature (atmospheric). *Aspergillus fumigatus* has a relatively high optimum temperature for growth. It grows very actively indeed at a temperature of 37° C., and very slowly at a temperature of 21° C.; and it would be only in the hot summer months that even this comparatively unfavourable temperature obtains; and so in this country (England) the temperature conditions are not such as to favour the growth of the fungus under saprophytic conditions. One important group of human cases appears to have been recorded in the southern part of France, where the temperature is much higher than it is in this country, and where the atmospheric conditions would be much more favourable to the saprophytic life of the fungus."

In British Guiana, where for at least nine months of the year the air is moist, and where the temperature varies from 23° C. to 35° C., the conditions for saprophytic life are ideal. It would appear that the natural life of this parasite is a saprophytic one, living in grain and herbage, and only occasionally finding in man or animals the conditions suitable to its parasitic powers. In Europe patients suffering from this malady are those who are connected with the feeding of animals, handling of grain, &c. For instance, cases occur in pigeon feeders, whose custom is to take the grain (maize, &c.) into the mouth and blow it through the beak and into the crop of the young pigeon; also amongst artificial hair combers, who are obliged to powder the hair with rye starch, which frequently contain numerous Aspergillus spores. The woman whose case is described above was in attendance on milch cows.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Septicemia and the *Filaria Bancroftii.*

In my last report from this Laboratory to the Tropical Diseases Research Fund (October to March, 1911-1912), there is an article relating to the connection between *Filaria Bancroftii* and deep-seated abscesses in the limbs.

In the Report of the Tropical Diseases Research Fund for the year 1907 will be found an article bearing on the same subject. The septic process was not, however, confined to the limbs, but was concerned with the lymphatics of the abdomen and thorax.

The exact relationship of the *Filaria Bancroftii* to septic processes such as abscess and septicemia has for long engaged the attention of this laboratory, and it is proposed in the following pages to record the results as obtained in this Colony.

The consideration of filarial abscesses in the limbs is omitted, since it has been dealt with six months ago.

The condition claiming attention is one of severe and extensive infection of the retro-peritoneal and retro-thoracic lymphatics. From the pelvic cavity to the region of the neck these lymphatics are filled with purulent matter in which abound streptococci of a virulent character. These suppurating lymphatics have also offshoots passing to the spermatic cord and testis, to the glands in the groin, and, by way of the axilla, to the upper arm.

The symptoms are, as would naturally be expected, those of a peritonitis combined with the constitutional effects of severe streptococcal septicemia. The presence of a large mass of infected lymphatics immediately posterior to the peritoneum and pleuræ causes an early infection of these cavities, leading to acute peritonitis and acute pleurisy. The natural opening of the thoracic duct into the junction of the left subclavian and left internal jugular veins leads a quantity of heavily-charged streptococcal material straight into the blood stream, causing all the effects of a septicemia.

The previous history of these cases gives little assistance; some have suffered from previous filarial manifestations, some have not; some have thickened skin areas or enlarged chronic glands, some have no external signs of disease. Many can date the onset of the symptoms to a trivial scratch or abrasion, to a wetting in the rain, or to a blow. Most of the patients examined were of a class and position on whose statements but little reliance can be placed.

So much sickness in British Guiana is due to transient attacks of ill-developed malarial fever, of short attacks of filarial disease, and of effects of the sun's rays, that the practitioner is not usually summoned until several days of an illness have passed, and until the customary local household remedies have been tried and have failed.

The practitioner, therefore, finds the disease firmly established and probably with severe symptoms well developed. Chilly feelings or a definite rigor with pain in the abdomen is a common type of onset. Occasionally, rigor follows rigor in fairly rapid succession, though usually nothing more than the chilly ague fit is felt. The pain is not intense, nor does it cause much distress. When the pain is a marked feature, it is greatest below the umbilicus, and increased by movement or by pressure. Superficial pain is usually absent, though deep pressure over the spinal column will reveal acutely-tender areas. Respiration is rapid and shallow, especially if the pleural cavities be involved. The abdominal muscles are not hard and board-like, but usually flaccid. The abdomen rarely becomes distended, tense or tympanitic, since the peritoneal inflammation is frequently limited to the posterior parts of the cavity. A first inspection through the parietes at necropsy will frequently fail to show that any inflammatory process exists. The pulse is small, hard, and rapid; the temperature is a very marked feature, and remains between 103° F. and 105° F. with slight daily remissions. The tongue, at first white and moist, becomes dry, red, and fissured. Vomiting is an early feature, and sometimes occurs before peritonitis can have developed. It is particularly distressing, especially when hiccough is associated. Headache is another marked early symptom, to be followed in some cases by delirium of a mild character.

The graver aspects of shock associated with certain kinds of peritonitis are absent.

Some tint of icterus is commonly recognised, while the deep, coarse yellow of jaundice is occasionally presented.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Effusion of fluid into the peritoneum is rarely found, the peritonitis being always of the dry, adhesive character, and the flanks thus always resonant.

This group of symptoms continues in varying degrees of severity until death occurs in from two to eight days.

As discussion of the pathogenesis and pathological anatomy will show, there is good reason to consider that in favourable conditions, and before the suppurative lesion has spread too far, it is possible that a cure may be effected. In the majority of instances, however, the prognosis is extremely grave, and death usually follows.

The diagnosis is difficult, since the causes of peritonitis are legion.

It is rare that palpation can reveal the retro-peritoneal swelling. If the mind be directed to this disease, and it be recollected, when presented with a case of peritonitis, there are certain pointers which may indicate to the practitioner the ultimate filarial origin.

The following lesions more especially claim attention, since this septicemia is not infrequently a sequela, and further, even is often anatomically directly connected with them: acutely tender suppurating groin glands, axillary or cervical glands, filarial fever with lymphangitis of the leg or arm, suppurative lesions of the scrotum and cord, deep-seated abscess of the leg or arm.

This disease is one which has been known for long past in this Colony.

For many years the post-mortem records of the Public Hospital, Georgetown, have been accurately and carefully kept; some of those of 1845 and 1850 are still extant.

To turn back no earlier than 1891, it is possible to find that there are records of 667 examinations done in that year. Amongst these 667 five are, without doubt, instances of the disease now under review. The accurate description of the reporter leaves no doubt as to the exact correspondence, though he does not ascribe the lesion to the influence of the *Filaria Bancroftii.*

The following are extracts from these reports. The first was done in August, 1891, on J. W., male, Barbadian, of 47 years, and black race :—

> " High degree of jaundice.
>
> " Recent pleurisy on the left side as a whole, and patches of recent lymph in right pleura.
>
> " Acute, dry peritonitis, no fluid in the cavity, coils of intestine glued together, easily separated. No tubercle, no perforation, no apparent cause for the peritonitis. Lymphatics at the back of the peritoneum filled with pus extending above the diaphragm. Some congestion of the small gut, particularly in the lowest few feet of the ileum. The rest of the alimentary mucous membrane is healthy looking, but containing a little more blood than usual, and tinged with jaundice. Peyers patches not specifically altered. Opening of the bile duct into duodenum very narrow and apparently impermeable, but no plug of mucus, and no special thickening of the walls of the duct. No gall stone was found. Much clay-coloured fæces, in the large gut especially. No bile in the intestine. Summary: Acute jaundice (catarrhal ?). Acute pleurisy and peritonitis of dry character."

Again, in a second case, the examination was performed in July, 1891, on C. K., a female adult of black race, born in British Guiana :—

> " Poorly nourished. Rigor general, organs warm. Slight jaundice. Lungs spongy throughout, slightly congested, and œdematous. Small and large intestine healthy. Pancreas 3 oz., pale, hard, and tough. Peritoneum acutely inflamed, the intestines being stuck together. No fluid pus. Lumbar lymphatic glands and vessels inflamed and purulent. Liver 54 oz., lower and posterior part covered with lymph, substance firm, cirrhotic and fatty. Uterus enlarged and adherent to left side, containing several fibroids. On both broad ligaments is a lymphatic, purulent mass, connected above with the lumbar glands.
>
> " Summary: Abscess of both broad ligaments, purulent peritonitis. Fibroids of uterus. Cirrhotic kidney and hypertrophoid heart."

In the third case examination was performed in March, 1891, on L. C., a female. black, 26 years of age, borne in British Guiana :—

> " No rigor (40 minutes after death). Membranes have a pale, icteric tint Pleuræ, both with recent pleurisy with soft lymph all over pleuræ, and semi-

purulent fluid on both sides. Lungs somewhat compressed with some œdema and congestion of otherwise healthy lung. Peritoneum showed recent lymph generally distributed, but without signs of acute peritonitic congestion anywhere. Small and large gut pale and œdematous without gross lesion. The pelvic region had pus in the subperitoneal tissue, this was traced along the lymphatics of the left groin, where there was an œdematous and purulent infiltration of the tissues. Liver 41½ oz., pale, tawny-yellow in colour, fattily degenerated as in septicemia, structurally healthy. Summary: Bright's disease. Pleurisy and peritonitis. Purulent cellulitis of left inguinal region."

The above three extracts (the facts concerning the present enquiry only have been transcribed) show very well that the disease was extant and well recognised as early as 1891. They are typical of many post-mortem descriptions that may be found here and there in these reports up to the present day.

Daniels and Conyers, in the British Guiana Medical Annual (Vol. 8, 1896, p. 53), writing of Elephantiasis and Filariasis, describe cases such as these :—

"On post-mortem examinations several cases of enormous dilatation of the lymphatics of the abdomen and thorax have been observed. Mention should be made especially of two such cases, in which acute septicemia was apparently the cause of death. One case followed an attempt to remove some varicose groin glands in association with varicose lymphatic dilatation in the groins, and is referred to as showing the risk attendant on surgical interference in these cases. In the second case, the patient, aged 19, a black, native of British Guiana, was admitted with high fever, collapse, and delirium, with pain and tenderness in the abdomen and in puffy swellings in Scarpa's triangle. He died 28 hours after admission, the temperature showing no marked remission. In addition to phenacetin and stimulants he was given quinine in 10-grain doses every four hours. At the autopsy there was marked dilatation of the lymphatics from the groin to the thoracic duct, which was also dilated.

"The lymphatics contained fluid of the colour and consistency of anchovy sauce, and the thoracic duct partially organised blood clot in its upper part; one kidney showed a small cyst, and both some subacute changes, but no marked cirrhosis. There was malarial pigmentation of the liver and spleen, but not recent. The membranes of the brain were congested, but there was no pigmentation of the substance of the brain or in the cerebral vessels."

Dr. G. C. Low writes in the British Guiana Medical Annual (Vol. 12, 1902, p. 8) on *Filarial lymphangitis* as follows :—

"A certain class of cases in Barbados is known as 'fever and ague' of the abdomen; these are rare and very fatal, but as far as I can ascertain no post-mortem examinations were made, and the condition of the patients, as to whether they were suffering from definite filarial diseases, such as orchitis, lymph scrotum, or varicose groin glands, was not stated. It is conceivable they might have been caused by lymphangitis of the large vessels in the abdomen, complicated possibly by abcess formation; but until post-mortem examinations are made this is only theorising."

Maxwell contributed an excellent article on filarial abscess to the Journal of Tropical Medicine and Hygiene (Vol. 4, 1901, pp. 395, 399). He apparently describes these septicemic cases as follows :—

"(*e*) Intra-abdominal and intra-thoracic abscess. Of the latter form I have no experience, but of the former I have met with two cases. In each case the illness coincided with the cessation of lymph fever attacks, and each case was desperately ill when admitted to hospital. Both had commenced in the way I shall hereafter describe as typical. In the one case I found a deep fluctuation in the left lumbar region, and opened an abscess under chloroform which was part peritoneal and apparently had no connection with any of the larger abdominal organs. The urine contained the faintest traces of albumen, but neither formerly or at the time of operation were there any symptoms pointing to disease of that organ. This case left hospital by his own request, and was still desperately ill. The abscess was draining well, but

as he had been ill two and a half months and was very weak, his recovery was far from certain, and the case is too recent for me to have had opportunity of learning the result. The second case came into hospital looking like a typical case of appendicitis. He also was very ill, and had been so for a month and a half. The abscess proved to be extraperitoneal, and extended both into the iliac fossa and down into the pelvis. In my opinion it began in the loose tissue about the iliac vessels, and the fact that the disease began with a rigor and immediate flexion of the right thigh on the abdomen to an extent I have never seen in an uncomplicated case of appendicitis gives some colour to this supposition. This case is still under treatment, and the abscess cavity shows no great readiness to heal up, while the patient is extremely weak, so that it is difficult to say how this case will end."

Manson (Tropical Diseases, 1908, pp. 619—620) writes as follows :—

"Sometimes the dead worm acts as an irritant and causes abscess, in the contents of which fragments of the filaria may be found. Such abscesses occurring in the limbs or scrotum will discharge in due course, or may be opened; they lead to no further trouble. Should they form in the thorax or abdomen serious consequences, and even death, may ensue."

Further—

"The death of the parental filaria is apt to be lost sight of as a possible cause of abscess in the subjects of filarial infection.

"Deep-seated pain in the thorax or abdomen, with inflammatory fever followed by hectic, and a diminution in the number of micro-filariæ in, or their entire disappearance from, the peripheral blood should, in such circumstances suggest a diagnosis of filarial abscess, and indicate exploration and, if feasible, active surgical interference."

It is difficult to ascertain the frequency of this disease, since "septicemia" or "peritonitis" covers a multitude of other conditions. It is, however, a well-recognised fact that septicemia and blood poisoning enjoy an unenviable frequency in British Guiana. Peritonitis from unascertainable origin is also frequent. How many of these doubtful cases have been afflicted with this type of septicemia it is impossible to say.

A search through the post-mortem records for some twenty years past shows that about 1 to 2 per cent. of the persons thus examined succumbed from this cause. Accurate figures fail again in this instance, since in many cases the data fail to indicate more than a dry peritonitis; these might have been cases of this disease, so that the above figures may be too low.

This septicemic condition associated with cellulitis of the lymphatics has been summarised in these post-mortem reports sometimes as peritonitis, septicemia, abscess of the broad ligament, cancer of the mesentery, filariasis, lumbar abscess, &c. It has been possible to collect and study thirty cases during a period of four years. These were in every instance examined on the post-mortem table. Four out of the thirty cases were recognised clinically as suffering from this disease, twenty-six were unsuspected by the practitioner. Twenty were of the male and ten of the female sex. This very marked preponderance of the male sex is closely associated with the frequent presence of the *Filaria Bancroftii* in the region of the epididymis and spermatic cord, and consequent chronic irritation or death of the worm apparently initiates at this point a septic process in the form of a lymphangitis or an abscess.

The black race provides twenty-four of the patients, while six are East Indians. This is in correspondence with the observed filarial distribution in the Colony. As Daniels pointed out (British Guiana Medical Annual, Vol. 8, 1896), the filarial infection amongst East Indians is 6·6 per cent., whilst that amongst British Guiana negroes is 22·5 per cent. Later figures by Wise (British Guiana Medical Annual, Vol. 16, 1908) show the percentage to be 5·9 and 21 respectively. The age incidence shows that no patients were under ten years of age, four were between eleven and twenty, eight between twenty-one and thirty, twelve between thirty-one and forty, and six over forty-one years of age. Thus the majority (twenty) were affected between twenty-one and forty years. This corresponds well with the ages at which other filarial diseases affect this population.

The various countries to which the patients belonged are as follows :—British

Guiana sixteen, Barbados seven, India six, and Surinam one. Barbados has an excessive number of cases, considering the proportion of Barbadians in the population of this Colony, but it is to be recollected that the negroes born in Barbados are specially susceptible to filarial diseases.

As regards the symptoms more particularly referable to this disease, the following table will indicate their frequency :—

Table 1.

Symptoms.	Frequency.	Percentage.
Peritonitis	23	76·6
Acute hydrocele	11	36·6
Enlarged and inflamed spermatic cord ...	15	50·0
Enlarged and inflamed groin glands ...	17	56·6
Icterus or jaundice	10	33·3
Lymphangitis of the limbs	5	16·6
Pleurisy	5	16·6

The pathological anatomy is one of very peculiar and striking characters. While certain parts of the pathological picture are dependent on the particular area in which the suppuration commenced, the central area to which all sooner or later converge is the retro-peritoneal or retro-thoracic lymphatics. Whether the inciting lesion is in the leg, in the epididymis, in the obturator region, in the groin glands, or elsewhere, the subsequent course is a slow progression of suppurative processes along the intervening lymphatics to a final culminating infection of the retro-peritoneal or retro-thoracic lymphatics.

This infection leads to a remarkable picture. The autopsy on such a case will at first reveal only a dry, adhesive peritonitis at the posterior aspect of the peritoneal cavity. If the hand be laid over the spine a very obvious mass will be felt closely applied to the anterior and lateral aspects of the bony column. Tracing this mass upwards it will often cease at or about the opening between the crura of the diaphragm. If, however, the suppurative process has extended through the opening, the mass will be found to proceed upwards over the thoracic vertebræ to end at any level in the thorax, or even, as in four cases, to end only in the fibro-connective tissue that signalises the ending of the thoracic duct into the junction of the left internal jugular and subclavian veins. In such cases a septic clot projects into the venous stream. Laterally the mass is limited by the lines of the ilio-psoas muscle, though not infrequently it will at points spread further. In three cases this mass had spread as far as the kidneys to which organs it had become closely applied since the lymphatics of the capsule of the kidney were involved. In one case a rupture of a lymphatic in the pelvis of the kidney had occurred into the cavity of the pelvis leading to pyuria. Below the mass usually lies along the iliac vessels reaching the internal abdominal ring. At this point connection will be found by the spermatic cord to the epididymis or straight to the groin glands. A sheet of suppurative lymphangitis is not infrequently to be found spread closely over the obturator muscles.

It will thus be realised that the area of lymphatics involved is large and extensive. The abdominal part of the mass has been weighed on several occasions, and has reached 45 ozs., 48 ozs., and 53 ozs.

The component parts of this mass are almost wholly lymphatics and lymph-gland tissue. The aorta, the inferior vena cava, and their branches, the adjacent connective tissue, nerves, &c., are involved and surrounded, but the main bulk consists of the above two constituents. Not only are the main lymphatic vessels occupied by the clotted and septic lymph, but in addition every space and cleft in which lymph is found circulating is dilated and filled with this material, so that where

before is simple connective tissue, there is now a thick sheet of tortuous and dilated lymphatics.

The lymphatic-gland tissue is undoubtedly greatly hypertrophied, and is found as large confluent areas in the lymphatic mass.

It is impossible to trace any definite vessels, but the main thoracic duct (*receptaculum chyli*) may usually be recognised. The vessels are all extremely thin-walled, distended, and markedly sacculated. The distension only extends a short distance, ending in a small hole which leads to two or three other sacculated distensions, each of which equally ends and continues in the same way; they are, in fact, dilated clefts of connective tissue, and not genuine permanent lymphatic vessels. The contents are either a brick-red fluid or a reddish-white clot. In the thoracic duct the clot frequently becomes a pure white, more especially at the upper ending of the mass.

This brick-red fluid oozes readily from the open structures when cut across. All graduations from white sterile clot to brick-red semi-fluid material, through many pin-head abscesses to frank, undisguised pus, may be found in a single mass.

In only three of the cases was the *Filaria Bancroftii* or its embryos found in the abdominal mass. In each case the worms were discovered about the level of the kidneys. In no case was the adult Filaria found in the thoracic duct at the upper end of the mass obstructing the lymphatic flow. Fourteen of these lymphatic masses were examined, and it is, of course, difficult to feel assured that every part has been rigidly examined.

Smears of the material in the lymphatics and glands show an enormous abundance of streptococci, and cultures bear out the extraordinary profusion of these organisms.

It is important to recognise that the abdominal condition is a secondary one, and that in every case, with one exception, the mass was connected with a similar lesion outside the abdominal cavity.

These extra-abdominal lesions are few but prominent, *e.g.*, acutely-tender glands in the axillary, cervical, or inguinal regions, suppurative lesions of the scrotum and cord, filarial fever with lymphangitis of the leg or arm, and deep-seated abscess of the arm or leg. Reference to the table of symptoms detailed above shows that acutely-inflamed glands were present in seventeen cases out of the thirty examined, suppurative conditions of the scrotum and cord in fifteen cases, and lymphangitis of the limbs in five cases. Only in one case was the lymphangitis of the retro-peritoneal lymphatics unaccompanied by some extra-abdominal cause.

This case was one in which the acute septic process had passed away and left the mass as a shrunken fibrotic tumour: it is thus quite possible that the original extra-abdominal disease had been present previously, but was at the time cured and unrecognisable. The acutely-inflamed glands of the groin are common, and require little notice here. They are very tender, obvious to the sight, projecting beneath the skin. Both femoral and inguinal glands are involved, and the separate gland masses are frequently joined either by fibrous tissue or by extension of the gland parenchyma.

In these glands adult filariæ or their remains are not infrequently found, and out of these seventeen cases their presence was demonstrated twelve times.

As a precursor to this septic abdominal condition tender enlargement of the axillary glands was only observed twice, and in one of these cases the cervical glands at the root of the neck were similarly involved. In both cases the glands were the result of lymphangitis of the arm. As a general rule in British Guiana the arm is far less commonly affected than the leg by filarial diseases.

The suppurative processes of the scrotum and cord appear to be less well recognised.

In this condition the testis is, as a rule, unaffected save for late secondary degenerative processes. The scrotum is frequently enlarged because the tunica albuginea is filled with a thick fibrinous purulent fluid teeming with streptococci. The spermatic cord is thickened, and may be up to 2½-3 inches in diameter, and sometimes simulates a strangulated hernia. It is acutely tender to the touch, and the glands in the groin may be in a similar condition.

Incision into the cord shows that the structure is involved in exactly the same lymphatic suppurative process as the retro-peritoneal lymphatics. The great

increase in size is due to a large increase in the number of visible lymphatics which have become dilated, tortuous, and filled with material which may be brick-red fluid, or brick-red clot, or fluid pus. Localised abscesses are frequent along the course of the suppurating cord. The skin is unaffected. It is particularly important to note that it is the rule to find the epididymis included in the suppuration, and in the epididymis within abscesses are found adult *Filaria Bancroftii.*

The association of filarial abscess in the epididymis with septicemia was pointed out by Wise in 1908 (British Guiana Medical Annual, Vol. 17, 1908, p. 45). " It will be noticed that most of the six cases of the table above (cases of which *Filaria Bancroftii* were found in the epididymis) died of septicemia. The presence of the filarial worm is usually closely associated with its point of origin, and thus the disease becomes allied to filariasis. Yet it differs widely in that it is a grave septic condition, all the lymphatics of the affected being loaded with purulent matter containing streptococci which infect the whole blood stream, most usually to a fatal result."

Out of these fifteen cases adult *Filaria Bancroftii* were found in the epididymis ten times. They were on each occasion dead, and generally in a state of disintegration. Short pieces are recovered which require the microscope to definitely decide their character. No doubt sometimes the proteolytic action of the pus had completely destroyed all the original worms present. These results are borne out by Bahr in his excellent report on Filariasis and Elephantiasis in Fiji (Journal of London School of Tropical Medicine, Vol. 1, Supplement No. 1, 1912, pp. 51-54).

He quotes three cases out of many instances : the first had five worms in the epididymis of both testes, but none in the substance of the testis; the second had calcified filariæ in the epididymis of the right testis; the third had calcified filariæ in both epididymes and the right spermatic cord.

In two cases the epididymis was natural. In one of these *Filaria Bancroftii* was found in an abscess in the cord.

There is good reason to believe that this condition is the same as that referred to by authors in Egypt and Ceylon.

Madden (Lancet, 1907, pp. 505-506) writes of cellulitis of the spermatic cord. He mentions this as being mistaken for " strangulated hernia." He describes the lesion as follows :—" A much infiltrated spermatic cord, the veins of which are all thrombosed and filled with purulent clot, while the rest of the structure is thickly studded with small abscesses or rather collections of pus scattered throughout a kind of spongy tissue in its whole length."

" After running a modified septic course, the patients usually do very well, but I have seen one fatal case in which death was due to septic absorption, owing, I think, to extension of the suppurative process along the retro-peritoneal tissues with a diffuse septic cellulitis in this situation."

Castellani (Lancet, 1908, p. 15, and Manual of Tropical Medicine, Castellani and Chambers, 1910, p. 1034) writes of the same condition as follows under the name of *Endemic funiculitis.* It has been known in Ceylon for twenty years or more as phlebitis of the cord or corditis. It has a sudden onset with pain in the cord and epididymis, leading to a grave condition with severe vomiting. It is easily mistaken for strangulated hernia. If not operated on there is no tendency to recover. Signs of general septicemia set in with jaundice, hiccough, and death in a few days. The cord is thick and inflamed. Yellow, creamy pus comes from the pampiniform plexus and vas. The epididymis is also involved, though not always.

A streptodiplococcus is found and cultivated, which is regarded as a secondary factor.

Castellani also makes the interesting remark that the older Ceylon practitioners have regarded this disease as filarial; he himself has twice found microfilaria in the cord.

Manson (Tropical Diseases, 1908, p. 630) writes of *Filarial orchitis* as follows :—" Without absolutely denying the existence of such a disease as *Malarial orchitis,* I would suggest that the affection described by the French and Indian writers referred to, and endemic inflammation of testes, spermatic cords, and scrotum generally, are of filarial origin."

From the above extracts it is apparent that the same, or an extremely similar, disease exists both in Egypt and Ceylon.

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There is no doubt that in some cases the retro-peritoneal cellulitis begins in an abscess around a filarial worm. Cases have been observed showing all graduations between the uncomplicated presence of the worm in the epididymis to the completely developed, extensive abdominal lymphangitis. Firstly, the living *Filaria Bancroftii* has been observed wandering up and down the spermatic cord and within the epididymis; secondly, the worm has been found dead in the epididymis enclosed firmly in a fibrous capsule; thirdly, the worm has been found in pieces undergoing proteolytic changes in an abscess of the cord, and also in an abscess of the epididymis; fourthly, the above condition has been observed associated with a suppurative lymphangitis of the cord extending to the external abdominal ring; fifthly, the suppuration has extended to the internal abdominal ring and there checked; sixthly, cases have been observed with all the above lesions, but in addition the purulent lymphangitis had progressed alongside the iliac vessels to the lumbar glands; and seventhly, there are further cases showing all the various extensions of this process described above, viz., up the spine through the retro-peritoneal and retro-thoracic tissues, down the opposite iliac vessels to the opposite internal abdominal ring, and also over the obturator region.

The abscess in the epididymis extends into the profuse lymphatic plexus of the spermatic cord, and so by direct anatomical continuity to the intra-abdominal lymphatics. The passage of the toxic products preceding the march of the micro-organismal invasion leads to a large exudation of lymphatic fluid (later tinged with blood) accompanied by leucocytes. This process extends to all the neighbouring lymphatic spaces and clefts, and thus is derived the large mass which is found lying over and around the spine. Repeated passage of toxic products damages the lymphatic endothelium, and leads later to clotting of the fluid. Streptococci always abundant, spread through this highly satisfactory and nutrient matter, converting it into thick, curdy pus.

The spreading suppuration is apparently able to progress in the contrary direction to that of the lymph stream since it is not infrequent to find a unilateral infection of the spermatic cord spread past the place of junction of the two common iliac vessels against the stream of the lymph, down the lymphatics of the other iliac vessel to the internal abdominal ring of the opposite side. It has never been observed to spread down the cord though there is frequently what may be called a sympathetic enlargement of the groin glands not extending as far as a suppuration.

The above steps in the progress of the disease have been also observed when the condition has arisen primarily from the inflamed glands in the groin.

The adult *Filaria Bancroftii* has been found in this series of cases in the glands of the groin in twelve out of the seventeen cases. The worm is not so readily found in the groin glands as in the epididymis, since in the latter the affected area is smaller and more readily examined; further, the groin glands are generally matted together and infiltrated with hard fibrous tissue rendering a thorough examination tedious and difficult. The number of cases in which the axillary glands formed the focus of the septic lymphangitis was only two. There is no reason to believe that the progress of the disease is any different to those in which it arises in the groin, but it is noticeable that the suppuration proceeds downwards through the thorax to the abdomen.

Save for analogy with the pathogenic process as exemplified by those cases arising in the groin and in the spermatic cord, it would be natural to consider that the process had originated within the abdomen, and subsequently spread to the axillary glands. This question as to intra or extra-abdominal origin of such cases can only be settled by further observation; these axillary cases are so rare in British Guiana that this point will remain long unsolved.

Observation and experience in British Guiana has shown that while the death of an adult *Filaria Bancroftii* may not infrequently lead to abscess when situated in the limbs, spermatic cord, or epididymis, the death of this worm within the abdomen or thorax rarely or never results in abscess. In this Colony the most usual sites in which to find the worm inside the abdomen are the lymphatic tissues about the aorta and vena cava, the lymph spaces beneath the epithelium of the pelvis of the kidney, the lymph spaces of the sheath of the ilio psoas muscle, and in Glisson's capsule. It is quite probable that these worms wander to all parts of the abdomen, but they may be more often and more easily found in the above sites. When found

they are either alive, or, if dead, in a process of calcification, which proceeds until the worm has shrunken to a small, coiled, calcareous nodule, about the size of a millet seed. As Wise pointed out (British Guiana Medical Annual, Vol. 16, 1908, p. 35, *et seq.*), the natural ending of the existence of the *Filaria Bancroftii* within the human body is calcification, and these calcified filariæ may be found in many situations.

Within the abdomen the filariæ always calcify or become fibrotic, and never within the present experience have led to abscess formation.

In the epididymis and the limbs the filariæ frequently calcify, but may, on the contrary, lead to abscess.

In the course of the last few years, filariæ, living calcified or undergoing disintegration in an abscess, have been found in the lymphatics of the following situations :—

The pelvis of the kidney thirty-one times, the epididymis eighteen times, the retro-perintoneal tissues twelve times, the ilio psoas muscles four times, Glisson's capsule twice, inguinal glands twenty-five times, and lymphatic vessels eight times.

There is another important pathological condition which may at times have great influence on the establishment of the septic lymphangitis in the abdominal vessels.

From time to time in the course of routine post-mortem examinations a simple non-inflammatory dilation of the retro-peritoneal lymphatics is encountered. This condition, though in a measure resembling the lymphangitis described above, yet is always far less extensive. The dilated vessels rarely extend below the level of the bifurcation of the aorta, and never to the internal abdominal ring. Laterally there is a distinct tendency to reach towards the kidney and become closely applied to that organ. Upwards the extension is never above the level of the two kidneys or slightly above.

A case of this type leading to chyluria was described by Wise in 1909 (Report Tropical Diseases Research Fund, 1909). The cause of these slight non-suppurative lymphatic dilations is undoubtedly filarial. The worm has never been found alive, but twice the worm was found obstructing in the inter-renal space completely membranous, four times it was calcareous, and twice it was only a fibrous nodule or a fibrous construction of a main lymphatic trunk.

Bacteriological examination of these thirty cases was also carried out, streptococci being observed microscopically in twenty-eight out of the thirty cases. In twenty instances the streptococci were isolated in pure culture and further examined.

In several of the earlier cases cultures were not obtained, since the streptococci refused to grow upon plain agar. The addition of a little glucose or some serum to the agar proved to be a palatable medium, and latterly no difficulty was experienced in obtaining pure cultures.

The reactions of the streptococci are tabulated as follows:—

Table II.

Number of Case.	Clotting of Milk.	Neutral Red.	Saccharose.	Lactose.	Raffinose.	Inulin.	Salicin.	Mannite.
4	O	O	X	X	O	O	O	O
5	O	O	O	X	O	O	O	O
8	O	O	X	O	O	O	X	O
9	X	O	O	X	O	O	O	X
11	O	O	X	O	O	O	X	O
12	X	O	O	X	O	O	X	O
13	X	O	O	X	O	O	X	X
15	O	O	O	X	O	O	O	O

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Number of Case.	Clotting of Milk.	Neutral Red.	Saccharose.	Lactose.	Raffinose.	Inulin.	Salicin.	Mannite.
16	O	X	X	X	O	O	O	O
18	O	O	X	O	O	O	O	O
19	O	O	X	X	O	O	O	O
20	O	O	X	X	O	O	O	X
21	X	O	X	X	O	O	X	O
22	O	O	O	X	O	O	O	O
23	O	O	X	O	O	O	O	O
24	O	O	X	X	O	O	O	X
25	O	O	O	X	O	O	X	O
27	X	O	X	X	O	O	O	O
29	O	X	O	X	O	O	X	X
30	X	O	X	X	O	O	O	O
Twenty	6	2	12	16	0	0	7	5

There is every reason to believe that these organisms are varieties of the common universal *Streptococcus pyogenes.*

Injection into animals produces subcutaneously an abscess, intra-peritoneally peritonitis and death. The pathogenicity of these streptococci sinks rapidly. The effect of the toxic products is intense, the smallest quantity of a killed culture scratched into the arm of a human being produces fever with a marked superficial lymphangitis and swelling of the glands involved.

No. 2.

BRITISH GUIANA.

The GOVERNOR to the SECRETARY OF STATE.

(Received 21 January, 1913.)

Government House, Georgetown,
Demerara, 4th January, 1913.

Sir,

In continuation of my despatch of the 20th December,* forwarding the Annual Report of the Surgeon-General for the year 1911-1912, I have the honour to invite special attention to the subsidiary report of Dr. J. E. A. Ferguson in charge of the Peter's Hall Medical District on the east bank of the Demerara River.

2. The very satisfactory results of the steps taken by Dr. Ferguson to eradicate ankylostomiasis and malarial fever on the estates in his district have rightly been brought to the notice of other Government medical officers and of estate managers by the Surgeon-General, in the enclosed circular letter, and seem to me possibly of wider interest for other Colonies where these diseases, and notably the former, prevail, and, as here, seriously affect the death-rate of the population.

I have, &c.,
WALTER EGERTON.

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* Not printed.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Enclosure 1 in No. 2.

Report on the Peter's Hall Medical District for the Year 1911-1912.

Sir, River View, East Bank, Demerara, 7th August, 1912.

I have the honour to report as follows on the Peter's Hall Medical District for the year 1911-1912:—

Estates.

In comparison with previous years there were fewer cases of malarial fever and pneumonia. On the other hand, diarrhœa, dysentery, and typhoid fever were more than usually prevalent, this being doubtless due to deterioration of the water supply resulting from the exceptionally long drought.

The following table shows the birth-rate and mortality of the four Diamond estates, taken together, for the year under report, compared with the average of the three previous years:—

The Diamond Estates.

Plantations Diamond, Farm, Providence and Peter's Hall.

	Birth-rate per 1,000.	Death-rate per 1,000.
1911-1912	29·5	20·3
Average of the three previous years ...	29·7	24·7

These figures have reference only to the East Indians residing in the four barracks, numbering 5,150, exclusive of those residing in the villages, pastures, &c.

It will be seen that last year the birth-rate exceeded the death-rate by 9·2 per thousand, and that the death-rate was 4·4 per thousand less than the average of the three previous years.

On Plantation Diamond proper, an exceptionally small number of births—52, equal to 23·9 per thousand, as compared with 72, equal to 33 per thousand, the average of the three previous years—has unfavourably affected the birth-rate of the four estates taken together.

Providence had the lowest death-rate, 16·9 per thousand. The same estate also had the highest birth-rate, 35·3 per thousand, followed closely by Farm with 34·8.

For some years past the birth-rate has been increasing and the mortality diminishing on these estates, especially Providence. I attribute this chiefly to the care exercised in the curative and preventive treatment of anchylostomiasis and malarial fever, the two main causes of sickness and death among the estate coolies. I shall consider these two causes separately.

Anchylostomiasis.—When I took charge of this district in 1904, I found this disease exceedingly prevalent on the estates. The great majority of the coolies harboured the parasite. Their efficiency as labourers was much impaired. In both sexes deaths from acute anchylostomiasis were distressingly frequent. Some of the women were rendered sterile by the more extreme degrees of anæmia. To those who were less anæmic the stress of pregnancy proved so exhausting as to lead, in most cases, to the death of both mother and fœtus. Thus the parasite not only increased the mortality of the estates, but also adversely affected the birth-rate.

The more severe cases of infection were first dealt with. It took me some years of persistent effort, by the use of thymol and other anthelmintics in cases treated in hospital, to rid the coolies of their more dangerous degrees of infection.

Some years ago the manager of Providence carried out on his estate an efficient system for the disposal of night-soil, which was subsequently adopted on the other three estates. Re-infection has thus been to a great extent prevented.

The general result has been that the stationary coolie population of those barracks is practically free from the more severe degrees of anæmia, a visibly anæmic person, if found there, being usually a new-comer from elsewhere. Deaths from acute uncomplicated anchylostomiasis are now quite exceptional. Pregnancy is seldom fatal from this cause. The improvement in the labour supply is manifest.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

But although very many of the coolies have been cleared of their parasites entirely, a considerable proportion of them continue to harbour the worms in numbers which, indeed, are too small to produce an obvious effect on them when otherwise free from disease, but which, under the strain of malarial fever, and other illnesses, assert their debilitating influence. These coolies are apparently in good health, and work well, but the worms are there, ready to complicate other diseases.

How to deal with these people without impeding the work of the estates is a problem which I began to set myself to solve about four years ago. Up to that time I had been, as it were, merely pursuing the infection from the rear. I now wished to make a frontal attack on it, and entirely eliminate the parasite from the barracks.

Clearly, to treat all these coolies in hospital with repeated heroic doses of parasiticide drugs was out of the question. There are so many of them that any attempt of the kind would have disorganised the work of the estates and cost a great deal of money; and, besides, such violent treatment would have been out of proportion to the mild degree of the infection. It was necessary to discover some method which, whilst practicable and efficient, would inconvenience no one.

In November, 1908, I began an experiment on a few willing subjects at Providence. I gave each of them a cachet of ten grains of thymol every night for a period of many weeks. They did not find this moderate dose of the drug to interfere in the least with their ordinary occupation. Repeated microscopical examination showed a gradual diminution of the number of ova in their dejecta, until at the end of four months the ova disappeared entirely.

This long-continued course of thymol produced no ill effect whatever, and cured completely the disease. From that time I began to use this method of treatment in numerous cases of anchylostomiasis at Albouystown Dispensary and elsewhere, with uniformly satisfactory results. A very large experience of this use of the drug has convinced me of the efficacy and absolute innocuousness of this mode of dealing with the very difficult problem presented by the wide-spread infection of the coolies on the sugar estates.

In the beginning of the current year, therefore, it seemed to me that the time had arrived for giving those coolies the benefit of this line of treatment. By means of microscopical examination of the dejecta, an anchylostome census of all the coolies in the barracks, from five years old upwards, has been making steady progress for some months. Completed at Farm, and nearly so at Providence, the census is proceeding apace at Diamond and will ultimately take in Peter's Hall.

As soon as the presence of ova is ascertained, the person is put on the " Thymol List," and begins at once to take ten grains of the drug every night, except on Saturdays, doing his work as usual. The coolies have taken to this treatment with remarkable readiness, being fully aware of its object and anxious to get rid of their parasites. I may mention that a thymol pulverette, coated with chocolate, is obtainable, which the coolies prefer to the cachet.

The first batch of coolies placed on the list in February at Farm have been re-examined, and nearly all of them have been found free from ova and taken off the list permanently. The others will be similarly re-examined after four months of treatment, and I anticipate that the bulk of them will be found free. Some stragglers may have to continue taking their dose for a month or two more.

It will be seen that, if this system is carried out accurately, the permanent residents in those barracks will be entirely freed from this dangerous infection in a very short time. It will then be a relatively simple matter to deal with new-comers in like manner.

I am glad to say that the authorities of the estates are taking a deep interest in this matter; and with their all-important help I expect that the undertaking will be entirely successful.

Malaria.—In April, 1910, I began to give quinine systematically to the coolies in the estate barracks as a preventive against this all-pervading cause of disease.

I started with the children at Providence. In the previous month a census of their spleens was taken, and complete lists were prepared of those whose spleens were distinctly enlarged, and of the others whose spleens appeared to be normal. Then I put them all, without exception, on daily doses of quinine suited to their

ages for the space of three months. The beneficial effect of this began to be perceived at once. Within a very short time malarial fever became less frequent, and convulsions practically ceased to occur.

Having thus brought them up to a more healthy standard, I restricted the daily doses to those with enlarged spleens, and relegated the others to a weekly dose. The manager gave me his enthusiastic co-operation, without which success would not have been attainable. The sick-nurse and his assistants carried out the additional duties thus thrown on them readily and whole-heartedly.

Not only have attacks of malarial fever almost ceased among those children, but their spleens have been steadily diminishing in size. Repeated spleenic censuses have resulted in a shortening of the list of those taking daily doses, and a corresponding lengthening of the weekly list.

The system was soon adopted by the other estates; and the matter was brought to the notice of the Medical Inspector at an early date.

In order to extend the benefit of this quinine distribution to the adults larger machinery was required. The managers of Farm, Providence, and Peter's Hall have solved the difficulty by dividing the ranges in their barracks among the drivers, each of whom is given charge of a few ranges. Each driver is supplied with two lists, one containing the names of those with normal spleens, the other, those with enlarged spleens. To the former he gives a weekly dose of five grains; to the latter, a like dose daily, with an additional five grains when the spleen is very large. The drivers are supervised by the principal sick-nurse. The occurrence of malarial attacks, and the results of the periodic spleenic censuses show which of the drivers distribute the quinine carefully, and which of them shirk the work.

The results are seen in the marked reduction of the number of cases of, and deaths from, malarial fever. The adoption of this systematic distribution of quinine to the adults by the drivers at Diamond would doubtless have a like happy influence on the sickness-rate and mortality of that estate.

The salutary effect of the adoption of these measures for the cure and prevention of anchylostomiasis and malarial fever is seen most markedly in the high birth-rate and low mortality of Providence barracks. A birth-rate of 35·3 and a mortality of 16·9 per thousand are highly encouraging figures.

There is therefore every reason to hope that, with the entire elimination of the anchylostome from these estates by the method described above, and the more complete control of malaria by still greater accuracy in the administration of quinine to the people, the birth-rate on these estates, in spite of the inequality of the sexes, can be kept well above 30 per thousand, and the mortality considerably below 20.

But a relatively high birth-rate, a low sickness-rate and mortality, and a prompt improvement in the labour supply, do not complete the list of benefits to be derived from these measures.

Anyone who has closely observed the East Indians in this Colony knows that there is a marked difference in physique between the immigrants and those born here. Speaking generally it may be said that, compared with the creole coolies, the immigrants are heavier and more muscular, their bones are thicker, their features coarser. They are stronger and more vigorous people. In a "tug-of-war" they run away with the creole-born.

The effect of local rearing on the race tends, therefore, to physical deterioration, to the production of a light-weighing, thin-boned, and delicate-featured man, having less capacity for prolonged, hard muscular effort.

Of the factors concerned with the production of this physical deterioration the two most important are, undoubtedly, malarial fever and anchylostomiasis.

The creole coolie, who begins to suffer from malarial fever in the first months of his existence, and who is burdened with an enlarged spleen from that time onwards throughout his growing years, lies under disabilities which are ceaselessly thwarting the natural tendency of the vital forces within him to raise him to his maximum of physical development. If to these disabilities from malaria be added the constant draining of his blood through the bites of anchylostomes, it is easy to understand that such an individual inevitably tends towards the ranks of the degenerate.

Many such are being reared in the villages of the Colony—a menace to its future vital interests.

On the sugar estates—the other great nursing-ground of the East Indian race here—the adoption of the modes of prevention described above will enable the children to grow into stronger, more virile and desirable citizens.

Water Supply.—On these estates an entirely satisfactory water supply remains a desideratum. The supply is best at Providence.

Villages.—The sanitary condition and water supply continue to be unsatisfactory.

I have no figures relative to the vital statistics of these villages. Fewer cases came under my notice during the year than in previous years.

I have, &c.,
J. E. A. Ferguson,
G.M.O.

The Honourable
the Surgeon-General.

Enclosure 2 in No. 2.

(Circular.)

Surgeon-General's Office, Georgetown, Demerara,
24th December, 1912.

Annual Report by Dr. Ferguson on the Peter's Hall Medical District, 1911-1912.

Sir,

Dr. Ferguson's Annual Report on the Peter's Hall Medical District for the year 1911-1912 is so very interesting and instructive that I have had it printed separately, and herewith forward you a copy.

2. A very careful perusal of this report will reveal what has been done and what can be done for the cure and prevention of ankylostomiasis and malarial fever. A birth rate of 35·3 and a mortality of 16·9 per thousand are, as Dr. Ferguson rightly says, " highly encouraging figures."

3. I commend this report to your most careful consideration. I am sure that with the hearty co-operation of all concerned the same good results can be obtained on every estate in the Colony.

I have, &c.,
J. E. Godfrey,
Surgeon-General.

To all Government Medical Officers,
Attorneys and Managers of Sugar Estates.

No. 3.

BRITISH GUIANA.

The DEPUTY GOVERNOR to the SECRETARY OF STATE.

(Received 30 September, 1913.)

Government House, Georgetown, Demerara,
12th September, 1913.

Sir,

I have the honour to transmit a report on tropical diseases research work in the British Guiana Laboratory during the half-year ended 31st March, 1913.

I have, &c.,
CLIFTON GRANNUM,
Deputy Governor.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Enclosure in No. 3.

Report of Tropical Diseases Research in the Government Bacteriological Laboratory, British Guiana, for the Six Months October, 1912, to March, 1913, by K. S. Wise, Government Bacteriologist, and E. P. Minett, Assistant Government Bacteriologist.

1. Epidermophyton Cruris *in British Guiana.*
2. *Epidemic Dropsy.*

Epidermophyton Cruris *in British Guiana.*

Tinea cruris appears to be rare in British Guiana; we cannot call to mind a previous case in the Public Hospital, Georgetown, or on the various sugar estates. Dr. Conyers, the Resident Surgeon, states he has not seen a case in his twenty years' experience of this Colony.

The following is a brief history of the first case :—

Patient J. C., an Englishman, age 32, overseer on a sugar estate, was admitted to the Public Hospital, Georgetown, suffering from a chronic form of intensely irritating skin lesion. No history of importance; never had syphilis; an attack of gonorrhœa four years previously.

He states the lesion first appeared on the neck, and resembled a small ringworm in appearance; it was intensely irritating. From this point it gradually extended to various parts of the body, the inner sides of the knees being particularly irritable, a condition patient ascribes to riding a mule. It was abundant on the feet and hands. On admission the most typical lesions could be seen on the nates, consisting of a continuous dull red surface extending outwards to the buttocks, where the eruption showed most picturesque gyrations, often enclosing areas of perfectly healthy skin. The recent patches were circular, the centre being of a silvery grey colour surrounded by a raised edge of bright red colour; this condition had been preceded by an intensely irritating area of a dull red colour.

The older patches were either a brick red or brownish colour, and had a very scaly surface.

The pigmentation did not persist for long, but gave way to a shiny white condition of the skin after the scaliness had worn off.

The second case was that of a Scotchman, age about 35, long resident in India, who was staying in Georgetown. The medical practitioner who was attending the case describes the patches as very much resembling ringworm. Scrapings of the skin were brought to the laboratory for examination and cultivation.

Both cases responded rapidly to treatment with chrysophanic acid ointment. Scrapings from both cases were examined in the laboratory. After soaking in caustic potash and mounting in glycerine, both cases showed the presence of a mycelium with a double contour, showing true branching, and composed of rectangular segments. The ends of the filaments were distinctly club-shaped. Interspersed between the mycelium were a large number of oval spores, each having a double contour and highly refractile in character. In case No. 1 no clusters of spores were observed, but case No. 2 showed the presence of a few clusters.

As the second case had already been treated with strong antiseptics before being seen by us, it was impossible to obtain cultures from the skin scrapings supplied. But scrapings obtained from case No. 1 were taken before treatment had been commenced. The patches were washed with ether, a few scrapings were then taken from the edge of an active patch and incubated in glucose broth. At the end of forty-eight hours a large number of oval spores, and a few short mycelial elements, were seen in a hanging-drop preparation.

Many of the cultivations were contaminated with a rich growth of *Staphylococcus albus*, but in two cases pure cultures were obtained and plated out on to glucose agar.

The growth first appeared in forty-eight hours as small, hard, raised areas of a dull grey colour; these were extremely difficult to remove from the surface of the medium. After further incubation, extending over seven days, the grey areas gradually spread in size and assumed a greyish white colour, still firmly attached

to the medium, circular in shape, and having a somewhat crinkled appearance on the surface.

Microscopically the growth was seen to consist of a highly refractile-jointed mycelium as above, with many spores, each with a double contour and highly refractile. The spores in the cultures were all observed singly, and no clusters were observed.

The best results for microscopic examination were obtained by staining a teased out portion of the specimen with weak carbol fuchsin solution for fifteen minutes, washing, and mounting in glycerine.

The condition and cultural appearances appear to resemble closely those described by Castellani as *Epidermophyton cruris* in 1905, and by Sabouraud as *Epidermophyton inguinalis* in 1907, as being common in Ceylon, and considering the large number of coolies regularly imported into this Colony it is surprising that the condition should be so rare.

Epidemic Dropsy.

In this Colony the interior is practically unexplored, and, therefore, expeditions sent up into the interior for collecting balata or gold have, in the absence of roads, necessarily to travel by means of the rivers, and should any distance be required to be covered on land, such, for instance, as a "portage" to avoid rapids in the river, a forest path has to be cut with much labour through the dense bush. Expeditions of this nature are frequently absent from Georgetown for many months at a stretch, during which time the members subsist mainly on tinned and other provisions which they carry with them.

In May, 1912, an expedition, consisting of 190 men, started from Georgetown with the intention of seeking balata on the grant of a company situated far up the Essequibo River, and about 30 miles from the Brazilian border. The members of the expedition consisted of creole mulattoes and black men, and was accompanied by a dispenser with a stock of medicines. These dispensers or sick nurses are usually men who have been trained in an estate's hospital or in the Public Hospital, Georgetown, and have good opportunities of diagnosing and treating the commoner diseases of the Colony under the supervision of a Government Medical Officer during their period of training and before qualification.

Many of the men of the expedition had had long experience in bush life, some having spent from eight to sixteen years as gold diggers and balata bleeders. The expedition was away from civilisation in the bush about seven months in all, and were employed mostly on the Roiwa grants several weeks going up the Essequibo River. The main camp was called Hopeful Camp, and situated on the main Essequibo River, near Cuywine Creek. The situation appears to have been a healthy and well chosen one, it being about thirty to forty feet above the river level, the soil consisting of fine sand and clay. The bush in the immediate neighbourhood of the camp was well cleared. There was a hill at the back of the camp, and an island on the river opposite the landing place.

No cases of sickness in the camp appeared until about four months after arrival, when members of the expedition were attacked by a disease new to them, characterised by pyrexia, general progressive œdema, and attended by vomiting. This disease in several cases proved rapidly fatal. The cases occurred at intervals of a few days over a period of two months, and continued until the return of the expedition to Georgetown; some cases occurring during the journey down the river.

Of the total expedition of 190 men, about 24 were affected, in seven cases the disease proved fatal. No history can be obtained from various members of the expedition when interviewed as to anything abnormal occurring as differing in any way from previous expeditions in which the men had taken part: special enquiries being made as to the presence or otherwise of an abnormal number of biting insects, bad food. The food consisted of two kinds—that given out to the general labourers, which consisted of brown creole rice (unpolished), flour, tinned beef, tinned pork, tinned salt mackerel, and sugar. That given to the staff appears to have been of rather more varied character—they were given white milled rice, and in addition drew on the general store for such extras as tinned corn beef, tinned salmon, grape nuts, oatmeal, and tinned peaches.

The daily rations per man were given as follows :—

2 oz. pork, 4 oz. sugar, and 1 pint rice, whilst the superintendent states that the rations were 2 oz. salt fish, 2 oz. pork, 2 oz. tinned beef, 2 oz. sugar, $\frac{1}{2}$ lb. rice, and 1 pint flour.

This scale of rations continued almost without interruption for a period of three months, with the exception of an occasional variation, such as fish from the river or fowls, when available.

Of those affected by the disease to be described two were of the staff, the remainder were labourers. The site of the camp appears to have been healthy, and the superintendent was stationed the previous year at a spot two days' journey lower down the river for a period of two months, without any ill effects.

The early symptoms consisted of a swelling of the feet and ankles, which gradually progressed up the legs to the thighs and abdomen, finally reaching as high as the thorax and neck before death occurred.

This œdema has a sudden and painless onset, the men frequently not noticing anything unusual until others noticed their feet to be swollen.

As the œdema spreads upwards, it is accompanied by a rise of temperature gradually developing into a persistent high fever of a continuous nature. No great pain was complained of beyond the feeling of "tightness," nor was any superficial eruption of any kind present; myalgia and paralysis are absent; vomiting was a persistent and distressing symptom. The swelling slowly extends upwards, the œdema pitting markedly on pressure, and the men stated that the affected legs became four times their normal size, and felt "as though they were going to burst" through the tense skin.

The œdema appeared to confine itself to the feet, legs, abdomen, thorax, and neck in the same order of gradual progression; curiously enough the arms appear not to be affected beyond a slight enlargement on the upper forearm, pitting markedly on pressure. Anæsthesia appears to have been absent, beyond a slight numbness in the toes and occasionally the fingers.

Respiration was unaffected until shortly before death; the men described the sufferers as "fighting for breath" towards the end only. Even in the early stages the affected men were unable to do laborious work without severe respiratory and cardiac distress. As the disease progresses the cardiac symptoms become more severe, the pulse is rapid and intermittent, the patient frequently faints, those affected being unable to walk about after a day or two, and reduced to lying in a hammock. Diarrhœa was present in most of the cases.

The senses remained clear throughout the disease, and no delirium was present; only one patient complained of abdominal pain; the remainder did not complain of pain in any way. In one case hæmorrhage occurred round the gums, and blood was detected in the urine. In the fatal cases death occurred suddenly and unexpectedly. In the cases that recovered the disease lasted from three to five weeks, and recovery appeared to be complete as regards the pyrexia and œdema, but cardiac weakness remains for a considerable time after apparent recovery, the heart beats becoming irregular and intermittent with exercise. Fainting is frequent at considerable periods after apparently complete recovery.

A black dispenser accompanied the expedition on this occasion, but his drugs were of no avail, and he himself contracted the disease and subsequently died. A blood examination was carried out on several of the members of the expedition who had returned to town still suffering from œdema in a small degree, although the temperature had subsided and vomiting abated for some time before examination. The red blood cells were normal in character, shape and colour, the hæmoglobin index was 85 per cent.

A differential blood count showed the presence of 43 per cent. of polymorphonuclear leucocytes, 20 per cent. of large lymphocytes, 20 per cent. of small lymphocytes, 6 per cent. of large mononuclear leucocytes, and 10 per cent. of eosinophiles.

Patients examined five or six weeks after the acute symptoms of the disease had subsided still showed signs of a small amount of œdema, and all complained of great cardiac distress on taking any active exercise. Otherwise these men appeared well, their knee jerks were present, and with the exception of the small amount of remaining œdema, nothing abnormal could be found on examination. The circulatory

system was normal until the patient was made to exert himself, when the heart immediately intermitted. There was a small amount of albumen present in the urine of two cases examined, but nothing very abnormal or sufficient to account for the œdema. This disease appears to be related to the class of diseases known as "nutrition" diseases, and is not unknown where large numbers of men work under similar conditions as regards food, &c.

A very similar outbreak occurred during the construction of the Madeira-Mamore Railway, in the State of Amazonas and Matto Grosso, Brazil. Dr. Lovelace (Journal of American Medical Association, December, 1912) describes an acute type of disease in which cardiac vascular symptoms were present, together with œdema and anasarca, rapidly developing dyspnœa and cyanosis, followed by death. The disease was more common in the later half of the year, and affected both the labourers and the better classes. The same disease has occurred previously in the Colony up the Corentyne River and also in Suriname.

Similar outbreaks have been reported in India at intervals since 1878, and occasionally also from other parts of the world.

There can be little doubt that the disease occurring in British Guiana is that known as epidemic dropsy, although it doubtless really belongs to that class of diseases known as malnutrition or deficiency diseases, as described by Funk. It belongs to the same group of diseases as beriberi, scurvy, infantile scurvy, pellagra, &c., and has been produced experimentally, such as the polyneuritis of birds produced by Fraser and Stanton, and experimental scurvy produced by artificial restrictions of diet.

It is probable that these diseases are due to deficiency in some essential substance in the food. It has been shown that from certain foods organic bases (called vitamines) can be extracted in small quantities, which prevent, and sometimes cure, the deficiency disease.

These organic bases, vitamines, have been found in fresh milk (unboiled), lime juice, Katjang idjoe beans, maize (fresh, healthy, and undamaged grain only), yeast, fresh vegetables, potatoes, &c.

These vitamines are probably destroyed at 100° C., as the constant feeding of infants on boiled milk gives rise to a condition known as infantile scurvy, which, however, does not occur if the milk is pasteurised at 80° C. only. The well-known scurvy of ships' crews, formerly so common in the days of sailing ships and long voyages, was doubtless attributable to a similar absence of vitamines; the disease rapidly gives place to treatment with lime juice containing the necessary bases. In the expedition here recorded, fresh food seems to have been practically absent from the dietary for a prolonged period, with the exception of an occasional river fish caught, or fowl purchased from the natives.

There can be no doubt that the long continued use of dried and tinned foods led to the deficiency of the necessary substances for preserving health, and that the outbreak of the disease was a direct result of this deficiency. It is more than probable that the occasional use of lime juice, with the addition of beans and potatoes to the diet, would have prevented the outbreak, as also would the use of fresh vegetables and fruit had they been procurable.

K. S. WISE.
E. P. MINETT.

4th July, 1913.

No. 4.

CEYLON.

THE ACTING GOVERNOR to THE SECRETARY OF STATE.

(Received 1 September, 1913.)

The Queen's House, Colombo, Ceylon,
13 August, 1913.

SIR,

I HAVE the honour to forward herewith, for transmission to the Advisory Committee of the Tropical School Research Fund, a report by Dr. Aldo Castellani on

research work carried out at the Clinic for Tropical Diseases and Bacteriological Institute during the period from April 5th to June 30th, 1913.

I have, &c.,
R. E. STUBBS,
Officer Administering the Government.

Enclosure in No. 4.

Report of Investigation Work carried out at the Clinic for Tropical Diseases and Bacteriological Institute during the Period from April 5th to June 30th, 1913, by Aldo Castellani, M.D., Director of the Clinic for Tropical Diseases and the Bacteriological Institute, Colombo, Ceylon.

I returned to Ceylon from leave on April 5th, 1913, and resumed duties the same day. During my leave in Europe I carried out a certain amount of research work in London at the Lister Institute of Preventive Medicine. I prepared—jointly with Dr. A. Chalmers—the second edition of our Manual of Tropical Medicine, and published several scientific papers. In the present report there are embodied the results of the work carried out in Ceylon during the last three months, and some unpublished work done at the Lister Institute during my absence on leave. I beg to express my thanks to Professor Martin and the governing body of the Lister Institute for allowing me to work at that Institution. I desire to express also my indebtedness to Mr. E. Burgess, Assistant Bacteriologist, for the very valuable assistance he has rendered me, especially in the work on vaccines and fungi. My thanks are also due to Dr. Fernando, my house physician.

I have carried out investigations on the following subjects :—

(1) A new intestinal protozoal parasite causing dysenteric symptoms in man.
(2) Peculiar bodies found in a case of tropical splenomegaly with fever.
(3) Cases of pseudo-diphtheria due to fungi.
(4) The plurality of species of the so-called thrush fungus.
(5) Typhoid-paratyphoid vaccination with mixed vaccines.

An Intestinal Protozoal Parasite producing Dysenteric Symptoms in Man.

In three cases of mine in Ceylon presenting dysenteric symptoms I have observed a peculiar large protozoal parasite which most probably was the cause of the condition. The first case occurred in 1909, but, as stained preparations of the parasite were not successful, I did not publish the observation in detail, though I briefly mentioned it in certain of my papers on intestinal diseases.

Symptoms.—In all the three cases the clinical symptoms were those of an ordinary mild type of dysentery, either amœbic or bacterial. The onset was rather abrupt, with severe abdominal pain, tenesmus and diarrhœa, with stools containing muco-pus and blood. The motions soon lost any trace of fæcal matter, and consisted only of muco-pus and blood. In all cases the microscopic examination showed absence of löschiæ, cercomonata, trichomonata, balantidia, and ova of worms; instead several large, motile, parasitic bodies were seen—to be described presently.

The general condition of the patients was never very serious. Fever was present at the onset in Cases II. and III., but did not exceed 101, and lasted only a day or two. The dysenteric symptoms disappeared very quickly after a few doses of saline mixture or castor oil. Complications were not observed except in Case III., in which slight signs of hepatitis were present, but rapidly disappeared. Relapses may occur as shown apparently by Case III.

Case I.—Singhalese man. Admitted to the Clinic for Tropical Diseases in January, 1909, suffering from an epiphitic skin disease. After four days in the Clinic, during which time he received no treatment of any kind, he one morning complained of very severe abdominal pains with muco-pus and blood in the stools. The stools were examined microscopically and large bodies were seen which I believe to have been absolutely identical to those found later in Cases II. and III., presently

to be described. Two films were made, but unfortunately the staining by Giemsa's was not successful. A dose of castor oil stopped all dysenteric symptoms the same day, and in the stools which were passed later no bodies were found.

Case II.—European passenger. Had lived in Southern India and Burma for several years. While in Colombo (April, 1913), on his way to England, was taken ill with dysenteric symptoms at one of the hotels. When I saw him the temperature was 101,° he complained of nausea, and of very severe abdominal pains with severe straining. The motions contained blood and muco-pus, and the microscopical examination showed the bodies (to be presently described) in fresh and stained preparations. No löschiæ were present nor trichomonata or cercomonata. Two emetine injections (gr. $\frac{1}{3}$ each) were given, and also every two hours a sodium sulphate and magnesium sulphate mixture (one drachm of each per dose). The motions became fæculent after a few hours, and the bodies were no longer present.

Case III.—European officer of the mercantile marine. Admitted to the General Hospital of Colombo in June, 1913, with dysenteric symptoms. Gave a history of two previous attacks of dysentery in Rangoon and Bombay. Temperature on admission 100°, pulse 90. The patient complained of severe abdominal pains and tenesmus with bloody stools since three days. Complained also of severe pain on the hepatic region. The tongue was coated. Examination of the chest revealed nothing abnormal. Palpation of the abdomen induced pain, especially on the sigmoid region and epatic region. The liver was slightly enlarged and tender, spleen normal. The usual sodium sulphate and magnesium sulphate mixture was given and within twenty-four hours the stools became fæculent. Before starting the mixture the stools contained many bodies identical to those of Cases I. and II. They quickly disappeared after a few doses of the mixture, even before the stools had become fæculent. No amœbæ were present at any time, nor trichomonata nor cercomonata. The bacteriological examination of the stools for bacilli of the dysentery group gave a negative result.

Description of the Parasite.

Fresh preparations.—In fresh preparations and hanging drops of the stools one sees large, rather elongated or oval motile bodies which, on a superficial examination, give the impression of being very large flagellates moving about. On close examination, however, no flagella can be detected. The parasitic bodies are large, elongated or oval, or somewhat roundish; one extremity seems to have a mammillary protrusion which has a peculiar, extremely frequent, vibrating movement, which makes one suspect the presence of flagelli or an undulating membrane, or cilia. Neither in fresh preparations nor in stained preparations have I ever been able to detect flagelli or cilia. The protoplasm has the same appearance all over the body of the parasite, presenting numerous roundish vacuoles, none of which are contractile. No distinct nucleus seems to be present, and there is apparently no distinct differentiation between ectoplasm and endoplasm. The parasite does not emit pseudopoda like an amœba; in fact, the changes in shape of the body of the parasite are slight, and very similar to those slight changes in the shape of the body as found in flagellates such as *Trichomonas hominis.*

The parasites move about fairly rapidly, though not so quickly as cercomonata or trichomonata. How motility is produced it is difficult to say; no pseudopoda are protruded, and the body of the parasite shows only slight changes in shape. The anterior portion, as already stated, shows extremely rapid vibratory movements, but no flagelli nor cylia are seen nor apparently a definite undulating membrane, nor have I been able to satisfy myself that there is emission of filiform pseudopoda.

Stained preparations.—All my preparations were stained with Giemsa. The typical parasites have a peculiar flask shape (see micro-photographs)* due to a peculiar mammillary formation at one pole, but round forms are also found. The maximum diameter varies between 40 and 55 microns, the protoplasm is stained blue, and presents numerous non-stained roundish vacuoles regularly distributed all over. In certain parasites a large mass of chromatoid, roundish granules are seen, but in many others it is absent. The granules have the appearance of cocci; but whether they are engulphed cocci or chromatin granules representing a diffuse nucleus I cannot yet

* Not reproduced.

say, but I am inclined to the latter opinion. In one specimen the chromatin particles were bacillary. In none of the bodies are flagella seen, nor cylia, nor any evidence of an undulating membrane.

Reproduction.—I am not yet in a position to state anything on this subject.

Cultivation.—Attempts at cultivation have failed.

Zoological position of the parasite.—As I have already stated in fresh preparations, the first impression on seeing these large bodies moving about, and with an extremity presenting rapid, vibratory-like movements, is that one has to do with flagellates with the flagelli at one end, but on closer examination no flagelli are ever seen either in fresh or stained preparations, nor are cylia evident. The parasite, therefore, apparently is not a flagellate. It cannot, in my opinion, be placed in any of the genera löschia, entamœba, vahlkamfia, paramœba, as pseudopoda are not protruded, and the changes in the shape of the parasite while moving are practically nil. It cannot belong to the genus chlamydophrys, as there is no shell. I am inclined to consider it to represent a new genus for which I suggest the term "entoplasma."

I wish to express my indebtedness to Dr. Fernando, First House Physician to the General Hospital, and to Mr. E. Burgess, Assistant Bacteriologist, for much assistance rendered, and to Mr. C. de Silva for the micro-photographs and drawings.

Protozoal-like Bodies in a Case of Protracted Fever with Splenomegaly.

The patient, Andreas, was a Singhalese boy 14 years of age. He was admitted to Dr. Grenier's Ward on the 30th March with history of fever of long duration. According to his relations the boy, when three years old, had several attacks of malaria which easily yielded to treatment. The present fever started—always according to his relations—when he was nine, and did not yield to native or European treatment. The boy was brought to the Colombo General Hospital on the 30th March, 1913. The fever, while the patient was in hospital, was generally intermittent, and did not respond to quinine given in massive doses by the mouth and by intramuscular injections. The boy was transferred, by kind permission of Dr. F. Grenier, to the Clinic on the 18th April. The fever continued of the same type, namely, intermittent, and the maximum temperature varied from 103° to 105° (see temp. chart). The attacks of fever did not start with shiverings; the defervescence was not accompanied by sweatings. The spleen was much enlarged and hard; the liver slightly enlarged; neither organ was tender on pressure. All other organs were normal. No enlargement of the lymphatic glands. The patient was somewhat emaciated.

Examination of the blood.—Four counts were taken. The average was: the r.b.c. were reduced to 220.000; leucocytes 5,200; hæmoglobin (Fleish) 30. A few nucleated red cells were present. Basophilia and chromatophilia not very marked.

Leucocytic differential count:—

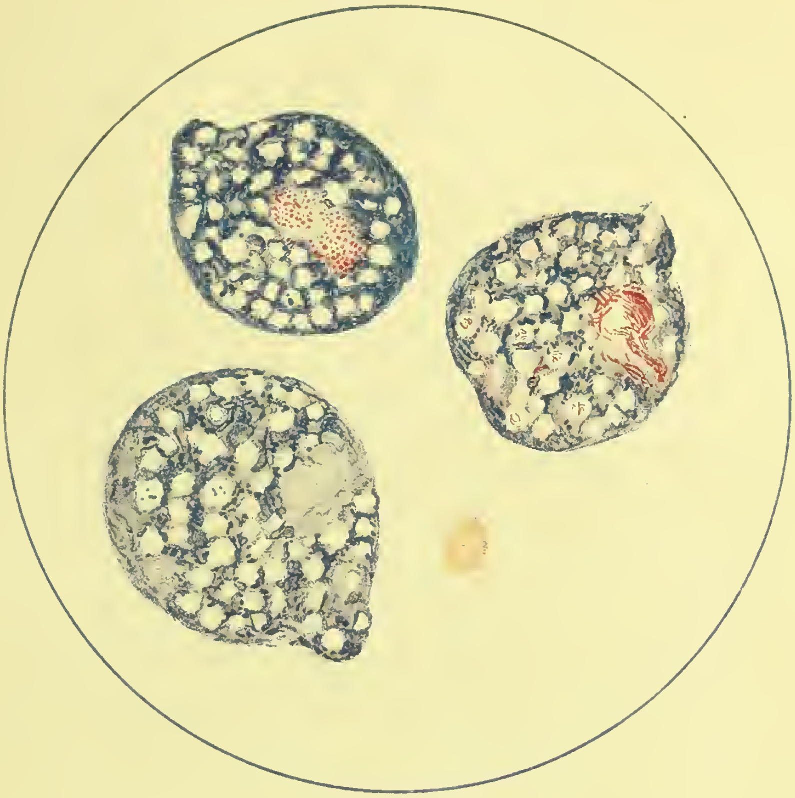
Polymorphonuclear	50 per cent.
Lymphocytes	40 ,,
Large mononuclear	7 ,,
Eosinophiles	3 ,,

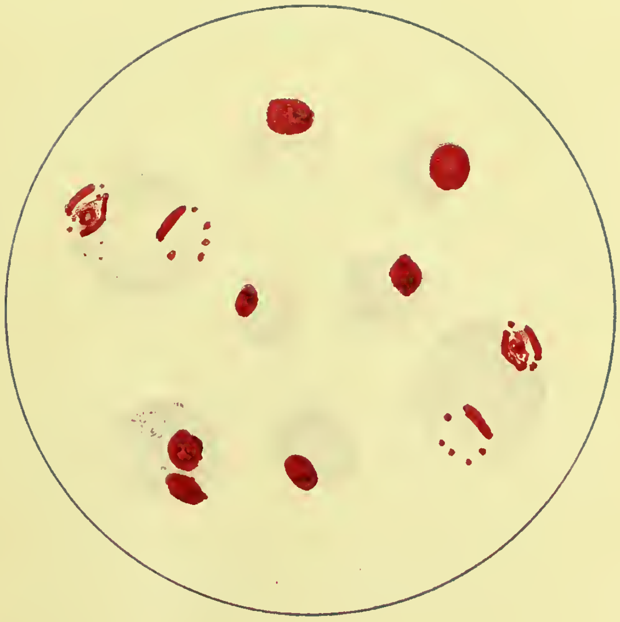
Serum reactions for Malta fever, typhoid, paratyphoid, always negative. Laveran's parasites always absent. No pigment. On two occasions peculiar bodies, to be described later, were found.

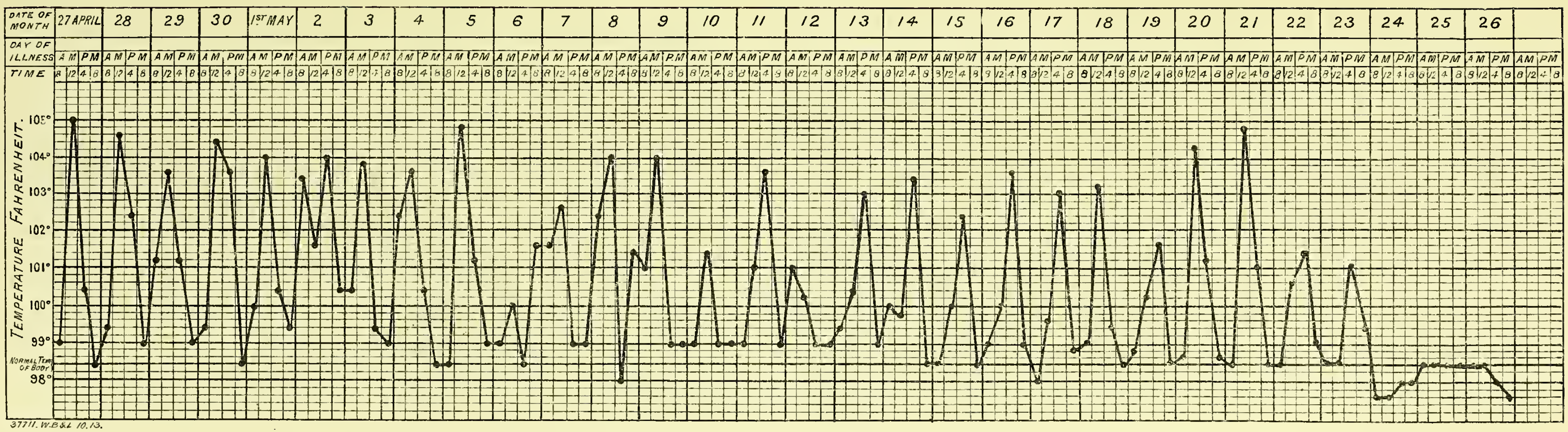
The urine.—Nothing abnormal was noted, except occasionally a faint trace of albumen.

Course and treatment.—Quinine was continued in massive doses (grs. 30 daily) without any effect. The general condition of the patient got gradually worse, and the boy became greatly emaciated. Death took place on the 26th May. Three days before death the temperature became normal.

Post-mortem.—The post-mortem examination was held three hours after death. Body greatly emaciated; all the organs of normal appearance, except the spleen, which was greatly enlarged, smooth, not very hard, not slate-coloured; the cut surface was of reddish colour. The examination of many films revealed absence of any malaria parasites, but some granules of a yellowish pigment were present. The presence of these rare granules of pigment does not, in my opinion, mean that the







DATE OF MONTH
DAY OF ILLNESS
TIME
27 APRIL
28
29
30
1ST MAY
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
105°
104°
103°
102°
101°
100°
99°
NORMAL TEMP OF BODY
98°
TEMPERATURE FAHRENHEIT.
37711. W.B.&L. 10.13.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

boy died of malaria; it means simply that probably the child years previously had suffered from malaria like the great majority of Ceylon children.

Description of the bodies found. Bodies found in the blood.—These are extremely rare. They are roundish or pear-shaped, with a maximum diameter of 7 to 12 micron. Most of them are vacuolated. The protoplasm by Giemsa stains a pale blue, and several large masses of chromatin are present. In one instance the faintest appearance of a very delicate flagellum seemed to be present. These bodies, for convenience sake, I will indicate as bodies of type I.

Bodies found in the spleen.—Two types are found, some, extremely rare, are identical to those found in the blood, or type I.; some, the great majority, are different. The latter, which, for convenience sake, I will call bodies of type II., are roundish or oval bodies three to six micron in diameter with protoplasm staining blue, and generally one large roundish mass of chromatin, two to four micron in diameter, at one pole. Occasionally, however, the body has two chromatin masses, one at each pole or close together. The bodies are generally free, only in one specimen I found some contained in a leucocyte. Those rare ones which have two chromatin masses have quite a different appearance from the Leishman's bodies, as the illustrations clearly show.

Nature of the bodies found.—The bodies of the type present in the blood (type I.) do not seem to be merely degenerated basophile cells with nuclear remnants; in such degenerated erythrocytes the dots staining red are, in my experience, generally small, much more scattered, and when stained by Giemsa generally are of a peculiar red, clearer and less purplish than the true chromatin. The bodies have none of the appearance of any kind of leucocytes or of red blood platelets. I was inclined at first to consider them to be related to Koch's bodies or "plasma-kugeln." These, as well known, are roundish, oval, or somewhat irregularly-shaped cells, eight to twelve microns in diameter, found by Koch in Africa in cattle affected with East Coast fever. Koch's bodies have recently been put in connection, by Gonder, with piroplasmata; in fact, that author believes them to represent a stage in the life of theilera parva.

Against the hypothesis that the bodies of type I. are "plasma-kugeln" would be the fact that in my case they were more common in the blood than in the spleen, and the chromatin masses contained in the bodies were much larger than those found in typical Koch's "blue bodies." As regards the bodies found in the spleen, or bodies of type II., there is no doubt that morphologically they closely resemble toxoplasmata, but for the fact that very rarely—only on one occasion—they were intraleucocytic. I have shown the bodies to Major James, and he too has been struck by the great similarity to toxoplasma. Other authorities have expressed the opinion that they are piroplasmata. Personally I am inclined to consider it to be a toxoplasma for which I have suggested the term *T. pyrogenes.* Even on superficial examination they cannot be confused with nucleated basophile red cells, nor with parasites of the genus Leishmania. Further investigation is necessary to see whether the bodies of type I. are connected with type II. in a somewhat similar manner as Koch's plasma-kugeln are connected with piroplasmata.

Cases of Pseudo-Diphtheria Due to Hyphomycetes.

The following cases may be of interest to those interested in diseases due to fungi. The first was observed in 1909; the second recently—May, 1913.

Case I.—Singhalese girl about 11 years, admitted to the Infectious Diseases Hospital with the diagnosis of diphtheria. There were white patches on the tonsils uvula and soft palate. The temperature was rather high, the pulse frequent and of low pressure. There was swelling of the lymphatic glands at the angle of the jaw. The child developed symptoms of broncho-pneumonia, and died three days after admission. Anti-diphtheria serum was given twice. The microscopical and bacteriological examinations of the patches for the Klebs-Löffler bacillus, carried out with the usual well-known technique by using serum media, &c., remained negative. No bacteria of any kind were seen in the specimens directly taken from the patches, but numerous mycelial and conidial elements of a fungus were present. On the

Appendix VI.

serum and glycerine agar media no colonies of diphtheria or other bacteria developed; instead an abundant growth developed of a fungus which further investigation showed to be *Monilia tropicalis* (see table No. I.) described by the writer in cases of bronchomycosis. At the autopsy the fungus was also found in enormous amount in the bronchi.

Table No. I.

—	Litmus Milk.	Glucose.	Lævulose.	Maltose.	Galactose.	Saccharose.	Lactose.	Mannite.	Dulcite.	Dextrin.	Raffinose.	Arabinose.	Adonite.	Inulin.	Sorbite.	Broth.	Peptone Water.	Indole.	Gram.	Gelatine.	Serum.
Monilia Tropicalis, Cast	A S, Alk.	A G	A G	A G	A G	A G	O	O	O	O	O	O	O	O	O	C T P	C	O	+	O	+ B

Abbreviations used in the table :—A, acid ; A/alk, acid then alkaline ; B, medium surrounding growth=brown ; C, clot ; C, clear (broth and peptone water) ; O, negative result, viz., neither acid nor clot in milk, neither acid or gas in sugar media, non-production of indole, or non-liquefaction of gelatine or serum, as the case may be ; T P, thin pellicle ; S, slight ; G, gas.

I am indebted to Dr. Spaar for the clinical notes of the following case :—

Case II.—European planter. Admitted to the Kandy Hospital on May 2nd, 1913. The illness had started two weeks previously. Temperature on admission 101°. Complained of severe pain in the throat and of difficulty in swallowing. Flushed face, felt extremely weak and exhausted. Sputum thick and swallowing painful and difficult. Fluids regurgitated through the nostrils. There was a profuse flow of saliva. The muscles of the neck were rigid, submaxillary glands enlarged and painful. The patient was unable to open the mouth wide. Tongue thickly coated and dry, soft palate swollen. Greyish membranes were present on the left tonsil, left anterior pillar, and soft palate. Diphtheria antitoxin (2,000 units) injected the same day into flank and a spray of hydrogen peroxide prescribed. During the next four days the general condition improved, but the white greyish membrane in the cleft between the left tonsil and the left anterior pillar was still very evident. Nine days after admission there was still a small whitish patch visible, but the patient felt quite well, and was discharged the following day.

Dr. Spaar sent swabs, taken with all precaution, to me for examination In smears made from the swabs no bacilli were seen, a few cocci were present, and numerous large mycelial segments of a fungus. Serum tubes and glycerine agar tubes were inoculated as usual, and given the presence of mycelial threads, also several sugar agars. The serum and glycerine agar tubes did not show any growth of the diphtheria bacilli; instead there was growth of a fungus to be presently described. The growth of this fungus was more abundant on the maltose and glucose media.

Characters of the Fungus.

In fresh preparations numerous roundish conidial elements and thick mycelial segments are seen. The fungus grows well in glucose and maltose media, and, though less abundantly, also on ordinary agar. The growth on glucose and maltose agar is of a light brownish colour, the surface having a peculiar crinkled appearance (see photograph).* The principal sugar reactions are collected in table No. II.

Table No. II.

—	Litmus Milk.	Glucose.	Lævulose.	Maltose.	Galactose.	Saccharose.	Lactose.	Mannite.	Dulcite.	Dextrin.	Raffinose.	Arabinose.	Adonite.	Inulin.	Sorbite.	Broth.	Peptone Water.	Indole.	Gram.	Gelatine.	Serum.
	O	AP	AP	AP	AP	OP	OP	OP	OP	OP	OP	OP	OP	OP	OP	CP	CP	O	+	O	O

Abbreviations used in the table :—A, acid ; C, clear (broth and peptone water) ; O, negative result, viz., neither acid nor clot in milk, neither acid nor gas in sugar media, non-production of indole or non-liquefaction of gelatine or serum as the case may be ; P, pellicle.

* Not reproduced.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Conclusion.—From the above two cases it would appear that hyphomycetes may give rise to a severe tonsilitis with serious local and constitutional symptoms which, on superficial examination, may be mistaken for diphtheria.

The Plurality of Species of the so-called "Thrush-Fungus."

In previous publications I have called attention to the widely different description the various authors give of the thrush-fungus. Some authorities (Hewlett), for example, state that the fungus liquefies gelatine, others affirm the reverse. Several writers give it as clotting milk, others as having no action on this medium. The sugar reactions have apparently been very little investigated. I hope to have already demonstrated in various publications that in the tropics the so-called "thrush-fungus," generally known by the term oidium or saccharomyces or *Monilia albicans*, does not represent a single species, but that the term covers a large number of different species of fungi, some of which probably belong to different genera. I thought it might be of interest to investigate whether the same conclusion could be come to in temperate zones. Thanks to the kindness of Professor Martin I was able to carry out some work on the subject at the Lister Institute of London. All swabs sent to the Institution for examination taken from cases of thrush stomatitis were kindly handed to me. Each swab was smeared on two maltose and two glucose agar plates, and every colony of fungi was investigated in the same manner as I had investigated the thrush fungi found in the tropics, viz., by passing them through a number of sugar broths, and growing them in milk, gelatine, and serum. It seems to me that the classification of fungi of the genera monilia, saccharomyces, and cryptococcus cannot be based purely on their morphology; their biochemical characters should be studied, and, whenever possible, their biological properties, such as productions of aglutinins, &c., in inoculated animals. The most important biochemical properties are put in evidence by growing the fungi in milk, gelatine, and various sugar broths. A large number of sugars should be used, in the same manner as is done in the classification of the various species of intestinal bacteria. It is to be noted that the reactions with certain sugars are constant, while with others, for instance, mannite, [they] may vary. It is to be noted also that, in analogy to intestinal bacteria, a species may be trained to ferment certain sugars in which it did not act when recently isolated. While taking all this into account, I believe the investigation of the various biochemical reactions to be of the greatest value for classifying these fungi.

In London, from 11 cases of thrush, seven different species of fungi belonging to the genus monilia were isolated. The characteristics of each species are collected in the following table :—

Table No. III.

Table showing cultural reactions of various species of monilias found in England, with names arranged in alphabetical order.

Fungi.	Litmus Milk.	Glucose.	Lævulose.	Maltose.	Galactose.	Saccharose.	Lactose.	Mannite.	Dulcite.	Dextrin.	Raffinose.	Arabinose.	Adonite.	Inulin.	Sorbite.	Inosite.	Salacin.	Amygdalin.	Isodulcite.	Erythrite.	Glycerine.	Broth.	Peptone Water.	Gelatine.	Serum.
Fungns, No. 1 ..	O	A G	A G V S	A G S	A S	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	C	C	O	O
" No. 2 ..	C	A G	A G	A G S	A	A	O	O	O	A S	O	O	O	O	O	O	O	O	O	O	A	C	C	O	O
" No. 3 ..	C	A G	A G	A G S	A G	A	A	A	O	A	O	O	O	O	O	O	O	O	O	O	O	C	C	O	O
" No. 4 ..	C	A G	A G	Alk	A	A G	A	O	O	O	O	O	O	O	O	O	O	O	O	O	O	C	C	O	O
" No. 5 ..	C	A G	A G	A	A	A	A	O	O	O	O	O	O	O	O	O	O	O	O	O	A	C	C	O	O
" No. 6 ..	C	A	A G	A G	A	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	C	C	O	O
" No. 7 ..	Alk	A G	A G	A G	A	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	C	C	O	O
" No. 8 ..	C	A G V S	O	A G V S	A	A	A	O	O	A	A	A	O	O	O	A	A	A G	O	O	A	C	C	O	O

Abbreviations used in the table :—A, Acid ; Alk, alkaline ; C, clot ; C, clear (broth and peptone water) ; G, gas ; O, negative result, viz., neither acid nor clot in milk, neither acid nor gas in sugar media, or non-liquefaction of gelatine or serum as the case may be : S, slight ; V S, very slight.

Morphologically all the fungi had the character of those belonging to the genus monilia. None belonged to the genus endomyces, no endospores and asci having been seen. They all grew abundantly on the various sugar agars, especially if slightly acid, less abundantly on ordinary agar. In solid media the fungi could not be distinguished one from the other. The growth was abundant, of a white creamy

colour. The fungi grew under two forms: a globular form morphologically similar to a typical yeast, and a filamentous form showing mycelial threads simple or ramified; asci and internal spores were always absent.

Comparison with the thrush-fungi found in the Tropics.—Anyone interested in the subject may compare the thrush-fungi found in London with those found in the tropics by comparing table III. with table IV.

Table No. IV.

Table showing cultural reactions of various species of monilias found in Ceylon, with names arranged in alphabetical order.

—	Litmus Milk.	Glucose.	Lævulose.	Maltose.	Galactose.	Saccharose.	Lactose.	Mannite.	Dulcite.	Dextrin.	Raffinose.	Arabinose.	Adonite.	Inulin.	Sorbite.	Broth.	Peptone Water.	Indole.	Gram.	Gelatine.	Serum.
Monilia																					
albicans (Ch. Robin) ...	AC	AG	AGs	AGs	AG	Avs	O	O	O	O	O	O	O	O	O	CTP	C	O	+	+	+s
blanchardi. Castellani ...	Avs/ Alk	AGs	A	A	A	A	O	O	O	O	As	O	O	Avs	O	C	C	O	+	O	O
bronchialis. Cast. ...	O	AG	AG	AG	O	AGs	O	O	O	A	O	O	O	O	O	C	C	O	+	O	O
burgessi. Cast. ...	O Alk	AGs	A	AGs	A	AGs	O	O	O	O	O	O	O	O	O	C	C	O	+	O	OB
chalmersi. Cast. ...	As Alk	AG	AG	As	AGs	AG	O	O	O	O	As	O	O	AGs	O	C	C	O	+	O	O
communis. Cast. ...	As D	A	AGs	Avs	A	AGs	O	O	O	A	AGs	O	O	O	O	C	C	O	+	O	OB
enterica. Cast.	O Alk	AG	AG	AG	AG	AG	O	As	O	As	O	O	O	O	O	C	C	O	+	O	O
faecalis. Cast.	A/ DPs	AG	AG	AG	AGs	AGs	O	O	O	O	O	O	O	O	O	C	C	O	+	O	OB
faecalis No. 2. Cast. ...	ACs	AG	AG	AG	AGs	AGs	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O
faecalis No. 3. Cast. ...	APs	AG	AG	AG	AGs	AGs	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O
guillermondi. Cast. ...	O/ Alk	AG	AG	As	A	AG	O	O	O	O	AGs	O	O	O	O	CTP	C	O	+	O	O
insolita. Cast.	As/ Alk	AG	AG	AG	AG	AG	O	As	O	O	O	O	Avs or O	O	O	C	C	O	+	O	OB
insolita No. 2. Cast. ...	As	AG	AG	AG	AG	AGs	O	As	O	O	O	O	Avs or O	O	O	C	C	O	+	O	O
intestinalis. Cast. ...	ADs	AG	AG	As	A	A	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O
negrii. Cast.	Avs/ Alk	AG	AG	As	AGs	AG	O	O	O	O	AGs	O	O	O	O	C	C	O	+	O	O
nivea. Cast.	O Alk	AG	AG	AG	AG	AGs	O	O	O	O	AG	O	O	O	O	C	C	O	+	O	O
nivea No. 2. Cast. ...	A	AG	AG	AGs	AGs	AG	O	O	O	O	AG	O	O	O	O	C	C	O	+	O	OB
nitida. Cast.	A/ DC	AG	AG	A	A	A	A	A	O	Avs	As or O	O	O	O	O	CTP	C	O	+	O	O
para-tropicalis. Cast. ...	As/ Alk	AG	AG	AG	AG	AG	O	O	O	Avs	O	O	O	O	O	CTP	C	O	+	O	O
pseudo-tropicalis. Cast.	ACs	AG	AG	O	AGs	AG	AG	O	O	O	O	O	O	O	O	C	C	O	+	O	O
perryi. Cast.	As/ DAlk	A	AGs	A	A	AGs	O	O	O	O	As	O	O	Avs	O	C	C	O	+	O	O
pinoyi. Cast.	O	AG	AG	AG	O	O	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O
pulmonalis. Cast. ...	O/ AlkD	AG	AG	AG	AGs	AG	O	Avs	O	O	A	AGs	O	O	O	CTP	C	O	+	O	OB
rhoi. Cast.	As/ Alk	AG	AG	Avs	AGs	AG	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O
rotunda. Cast.	AC	A	A	A	A	O	A	O	O	O	O	O	O	O	O	C	C	O	+	O	O
rugosa. Cast.	A/ PsCs	As	As	As	As	As	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O
tropicalis. Cast. ...	A	AG	AG	AG	AGs	AGs	O	O	O	O	O	O	O	O	O	C	C	O	+	O	OB
tropicalis No. 2. Cast. ...	As/ Alk	AG	AG	AG	AG	AG	O	O	O	O	O	O	O	O	O	CTP	C	O	+	O	OB
tropicalis No. 3. Cast. ...	O/ Alk	AG	AG	AG	AG	AG	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O
zeylanica. Cast. ...	ACS	A	A	A	A	A	As	O	O	A	Avs, Gvs	O	O	Avs	O	C	C	O	+	O	O
monilia (?) Krusei. Cast.	O	AG	AG	O	O	O	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O

Abbreviations used in the table:—A, acid; A alk, acid then alkaline; Alk, alkaline; B, medium surrounding growth—brown; C, clot; C, clear (broth and peptone water); D, decolourized; G, gas; O, negative result, viz.: neither acid nor clot in milk, neither acid nor gas in sugar media, non-production of indole, non-liquefaction of gelatine or serum as the case may be; P, peptonized (milk); TP, thin pellicle; +, positive result; s, slight; vs, very slight.

Conclusions.

1. The term thrush-fungus (monilia, saccharomyces, oidium albicans) does not indicate a single species of hyphomycete, but both in temperate and tropical zones has been used to cover a large number of different species. In fact, the term has been used to cover a number of different species of fungi in the same manner that the term b. coli was for years applied to a multitude of different intestinal bacteria when a few fermentation tests only were carried out.

2. The fungi found in 11 cases of thrush-stomatitis investigated by me in London belonged to seven different species of the genus monilia, Gmelin, 1791.

3. The fungi found in the London cases were different from those found in the Ceylon cases.

Typhoid—Paratyphoid Vaccination with Mixed Vaccines.

Considering the fairly frequent occurrence of paratyphoid A and paratyphoid B in tropical regions, at least, in Ceylon and India, I have since several years advocated the use of a mixed vaccine, viz., typhoid + paratyphoid A + paratyphoid B, instead of the usual simple typhoid vaccine. My belief in the possibility of an efficient mixed vaccine being produced was based on the experiments I carried out in Bonn, working under Professor Kruse, during the years 1901 and 1902. I demonstrated then (see Zeit. für Hygiene, 1902) that, by inoculating an animal with two different bacteria at the same time, the blood produced agglutinins and immune bodies for both, and that, provided a sufficient minimum quantity had been inoculated, the amount of agglutinins and immune bodies for each germ was about the same as in the animals inoculated with one germ only. I demonstrated that even inoculating a rabbit with three different micro-organisms (*B. typhosus* + *B. pseudo-dysentericus* No. 1 (Krause) + strain of *B. coli communis*) the amount of agglutinins and protective bodies elaborated for each germ was nearly the same as in animals respectively inoculated with one germ only. During the course of these experiments I was able to confirm that when the immunisation is obtained by a single inoculation, provided the minimum dose sufficient to obtain the maximum immunisation be given, the amount of agglutinins and immune bodies elaborated by the inoculated animals is not in proportion to the amount of cultures injected. A series of rabbits inoculated with 2 c.c. of typhoid cultures will give the same average agglutination limit and the same amount of immune bodies as a series of rabbits inoculated with 4 c.c.

Since 1905 I have experimented with several mixed vaccines in man, of which the principal ones are a typhoid + paratyphoid A + paratyphoid B vaccine, and a typhoid + dysentery (Kruse-Shiga) + dysentery Flexner vaccine. I will limit my remarks to the typhoid + paratyphoid A + paratyphoid B vaccine, but I may be allowed to note that anyone wishing to experiment with mixed dysentery vaccines should be careful always to use peptone-water cultures, as broth cultures of dysentery give rise to an extremely painful infiltration at the point of inoculation.

Method of preparation of the mixed typhoid-paratyphoid vaccine.—The mixed vaccines as prepared by me are either dead vaccines, the cultures being killed in the usual way by heating at 53° C., or live attenuated vaccines by heating the cultures at 50° C. for an hour.

Notes on the subject of mixed vaccines may be found in my old publications in the " Centr. fur Backteriologie " (1909), in the " Transactions of the Bombay Medical Congress " (1909), and in the " Ceylon Medical Reports."

During recent years I have used rather extensively both the dead mixed vaccine and the live attenuated one. The preparation was a simple one; several tubes containing 10 c.c. of broth each were inoculated with two loopfuls of an agar culture of typhoid twenty-four hours old; other tubes with two loopfuls of paratyphoid B, and others with two loopfuls of paratyphoid A. All the strains I used were non-virulent, but rich in antigen, as shown by animal experiments. The inoculated tubes were kept for twenty-four hours in the incubator at 35° C. These cultures were heated in a water bath at 55° C. (dead vaccine) or 50° C. (live attenuated vaccine) for an hour; they were then mixed together in certain proportions in sterile petri dishes—two tubes (20 c.c.) of typhoid, one tube (10 c.c.) of paratyphoid B, and one tube (10 c.c.) of paratyphoid A. The mixed vaccine consisted then of two parts typhoid, one part paratyphoid A, and one part paratyphoid B I used to give ten minims of the mixed vaccine at the first inoculation, and twenty or more at the second. At the present time the vaccine is standardised by counting the germs before mixing. The dead mixed vaccine I use since I returned to Ceylon contains per c.c. 500 millions typhoid, 250 millions paratyphoid B, and 250 millions paratyphoid A. A little lysol (0·2 per cent.) is added to the dead mixed vaccine. I give 0·6 c.c. of the first time and double dose the second. Whenever possible I give a third injection—the same amount as the second.

Dose and method of vaccination.—As already stated the mixed vaccine I now use —either the dead one obtained by heating cultures at 53° C. or the attenuated live one prepared by heating cultures at 50° C. for an hour—contains per c.c. 500 millions

typhoid, 250 millions paratyphoid A, and 250 millions paratyphoid B. I give 0·6 c.c. the first time and double the dose a week later. In some cases, however, I give only ½ c.c. the first time and one c.c. the second. At times I give a third inoculation two weeks after the first—the dose being the same as for the second. Very thin, delicate individuals and young women receive a little less; children between 8 and 15 one-quarter to half the adult dose. The inoculation of the mixed vaccine is followed by a local and general reaction, which, as a rule, is not much severer than after the inoculation of simple typhoid vaccine. Three or four hours after inoculation the region on the arm where the injection has been made becomes painful and red, and fever supervenes, which does not last longer, as a rule, than 24 to 36 hours, and does not in most cases incapacitate one for work.

As I do not believe that the immunisation given by bacterial vaccines lasts in man very long, I generally advise people to be vaccinated once every two years, or even once a year.

Innocuity of the mixed vaccine.—The mixed vaccine, either the dead one or the attenuated live one, is innocuous. Professor Browning, the Director of the Ceylon Government Chemical Institute, has to date received 32 inoculations of mixed live vaccine at one or two weeks intervals, in addition to 29 inoculations of simple typhoid live vaccine. He has always remained in very good health.

Remarks on the immunisation obtained in man by the mixed vaccine.—Lack of time has prevented me to study the amount of all protective substances produced in inoculated individuals. I have limited myself to study comparatively the amount of agglutinins produced.

Two natives, David and Fernando, were inoculated with mixed (dead) vaccine 0·6 c.c. the first time, 1·2 c.c. after a week.

One native, Peter, was inoculated with simple typhoid vaccine (dead) 0·6 c.c. the first time, 1·2 c.c. after a week.

One native, Baba Singho, was inoculated with simple paratyphoid A vaccine (dead) 0·6 c.c. the first time, 1·2 c.c. after a week.

One native, Asson, was inoculated with simple paratyphoid B vaccine 0·6 c.c. the first time, 1·2 c.c. after a week.

Two natives, A. E. De Silva and D. Gunasekera, were inoculated with 0·6 c.c. mixed live (attenuated) vaccine and with 1·2 c.c. after a week.

One native, Isaac, was inoculated with 0·6 c.c. live (attenuated) typhoid vaccine and with 1·2 c.c. after a week.

One native, Wellan, was inoculated with 0·6 c.c. live (attenuated) paratyphoid A vaccine, and with 1·2 c.c. after a week.

One native. Karuppen, was inoculated with 0·6 c.c. live (attenuated) paratyphoid B vaccine and with 1·2 c.c. after a week.

All the inoculated persons were healthy young natives who volunteered for the experiment. They were inoculated on the same days, the first inoculation taking place on the 14th June, 1913, and the second on the 21st June. The blood of all the inoculated persons was investigated for presence of agglutinins regularly, and the results are collected in the following table. I am much indebted to Mr. Burgess for the great assistance given, and for very carefully compiling the table :—

Table No. V.

Vaccine.	Name.	Limits of Agglutination.																	
		Typhoid.						Paratyphoid A.						Paratyphoid B.					
		Days after 1st inoculation.						Days after 1st inoculation.						Days after 1st inoculation.					
		7	14	21	28	35	42	7	14	21	28	35	42	7	14	21	28	35	42
Mixed dead	David	O	1/400	1/200	1/200	1/300	1/80	O	1/60	1/60	1/60	1/100	1/60	O	1/20	1/40	1/20	1/60	1/20
	Fernando ...	O	1/300	1/200	1/200	1/300	1/300	O	1/60	1/60	1/40	1/60	1/80	O	1/40	1/60	1/60	1/60	1/80
Typhoid dead ...	Peter	1/20	1/500	1/500	1/200	1/300	1/150	O	O	O	O	O	O	O	O	O	O	O	O
Paratyphoid A. dead ...	B. Singho ...	O	O	O	O	O	O	1/20	1/80	1/20	1/40	1/60	1/80	O	O	O	O	O	O
Paratyphoid B. dead ...	Asson	O	O	O	O	O	O	O	O	O	O	O	O	O	1/80	1/60	1/60	1/80	1/60
Mixed live	A. E. de Silva ...	1/20	1/300	1/500	1/200	1/200	1/100	O	1/40	1/40	1/20	1/40	1/20	O	1/40	1/40	1/20	1/40	1/20
	D. Gunasekera...	O	1/500	1/300	1/200	1/200	1/100	O	1/60	1/40	1/40	1/40	1/40	O	1/20	1/60	1/60	1/60	1/20
Typhoid live	Isaac	O	1/400	1/300	1/300	1/300	1/300	O	O	O	O	O	O	O	O	O	O	O	O
Paratyphoid A. live ...	Wellan	O	O	O	O	O	O	O	1/100	1/80	1/60	1/60	1/80	O	O	O	O	O	O
Paratyphoid B. live ...	Karuppen ...	O	O	O	O	O	O	O	O	O	O	O	O	O	1/20	1/80	1/80	1/60	—

From the table it will be seen that agglutinins seldom appear before the seventh day, and that the individuals inoculated with a mixed typhoid+paratyphoid A+paratyphoid B vaccine produced agglutinins for all three germs, and that on the average the amount of agglutinins produced for each germ was not much smaller than in the individuals inoculated with one germ only, although the latter had a much larger dose of the germ. Although, of course, one cannot gauge the actual immunisation obtained by simply studying the agglutination, there can be no doubt that to a certain extent agglutination is a rough index for immunisation. It seems to me that these results are decidedly in favour of the advisability of using a mixed typhoid+paratyphoid A+paratyphoid B vaccine in countries where all three diseases are met with.

Conclusions.—The use of the mixed typhoid+paratyphoid A+paratyphoid B vaccine, either the dead or the live (attenuated) one, is harmless. As there is such a general objection to the use of live vaccines, I recommend, for routine use, the mixed dead vaccine.

2. The inoculation of such vaccine in human beings in the doses mentioned in this paper induces a production of agglutinins for all three germs—*B. typhosus*, *B. paratyphosus A*, and *B. paratyphosus B*. The amount of agglutinins elaborated for each germ is nearly the same as in individuals respectively inoculated with typhoid vaccine only, paratyphoid B vaccine only, paratyphoid A vaccine only.

3. In countries where, besides typhoid, there occur paratyphoid A and paratyphoid B, a mixed vaccine should, in my opinion, be used instead of the simple typhoid vaccine. This has been done in Ceylon for the last four years with good results.

ALDO CASTELLANI.

No. 5.

FIJI.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received 27 November, 1912.)

Government House, Suva, Fiji,
24th October, 1912.

SIR,

I HAVE the honour to forward six copies of a Report* by Dr. Lynch, the Chief Medical Officer, on the work of the Medical Department for the year 1911.

2. Any points in the report which require action will be dealt with in due course.

3. On pages 38 to 43 the results of experiments in cases of yaws of the drug "Salvarsan" (606) are given, and those results are of interest in connection with the papers enclosed in your despatch of the 12th July last.† From the annexed copy of a minute by the Chief Medical Officer it will be seen that Dr. Lynch is of opinion that in some cases there is great risk in the use of the drug, and that caution must be used in its employment.

I have, &c.,
BICKHAM ESCOTT,
Governor.

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* Extract only reprinted.

† Not printed.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Enclosure 1 in No. 5.

Extract from the Annual Medical Report, 1911.

* * * * * * *

Report on the Treatment of Fijian Yaws and Syphilis in Indians by 606 in 1911 by P. H. Harper, Resident Medical Superintendent, Colonial Hospital.

During the last four months, 51 cases of yaws and 15 of syphilis have been treated at the Colonial Hospital, Suva, with Salvarsan (606). The following table shows the nationality of the patients treated and the methods employed:—

Nationality.	Cases of Yaws.		Cases of Syphilis.	
	Male.	Female.	Male.	Female.
European	1	—	—	—
Fijian	11	10	—	—
Indian	4	—	11	4
Samoan	3	4	—	—
Half-caste (Fiji-European) ...	—	2	—	—
Wallis Islander	1	—	—	—
Total	20	16	11	4

Methods.—Intravenous (sometimes followed by intramuscular injection), 19 (one death); intramuscular injection (1 in 10 aqueous solution), 23; subcutaneous injection (1 in 10 aqueous solution), 6; injection of serum from treated patient, 2; injection of serum followed by subcutaneous injection, 1: total, 51.

The possibility of cure.—In common with most of the medical men in Fiji, I am convinced that yaws, as seen here, is a clinical entity, distinct from syphilis. Though in some cases, especially of Indians, it is difficult or impossible to diagnose between the two diseases in their secondary and tertiary manifestations, in the vast majority of cases a differential diagnosis is possible even on clinical grounds alone. Whereas it may be truthfully said that a syphilitic patient is cured if the serum reaction remains negative for two years after treatment, I am convinced that we cannot definitely assert that Fijian yaws is cured. Such a statement is not warranted until we have learnt the history of a large number of patients many years (say, ten years) after their treatment. The difficulty of this question will be much enhanced by possible reinfections. It is unwise, therefore, to be led away by the miraculous disappearance of all symptoms in cases of yaws treated by salvarsan. The cases treated at the Colonial Hospital, Suva, were not picked. They were taken in order as they came to hospital, and as time allowed. Some held out a favourable prospect of apparent cure in any case; but one man, I think, cannot possibly be cured by any treatment. He has a chronic ulcer of the plantar surface of his right heel. He has been well treated for many years, but the amount of scarring quite precludes a healthy sole being formed to his heel. His ulcer, after many vicissitudes, has been frequently healed; but I do not consider that grafted skin can bear the strains to which a Fijian's heel is subjected, and without grafting his heel will be supported by very atrophic scar tissue. He is now, after treatment with salvarsan, being subjected to the graft operation.

Death.—There was one death in this series. A female Fijian of about 50 years of age had been known at the hospital for some years as the subject of a chronic yaws ulcer of breast. She was a typical subject of chronic yaws cachexia, with chronic nephritis (probably due to the arterial disease dependent upon chronic yaws cachexia). Considering the yaws cachexia to be an indication for a full dose of salvarsan, on 19th August, 1911, she was given ·6 gram salvarsan intravenously. An hour later she had a violent rigor, temperature 103° F., very rapid weak pulse, and vomiting. Throughout the night she was given strychnine and digitalin four-hourly. On the 20th she was still very weak; her pulse was poor, and food made her sick. Her bowels were kept open by enemata. Her urine was solid with albumen. On the

21st she complained of pain in her abdomen and joints. The muscles of her legs were tender on pressure. On 24th, jaundice set in, her listlessness increased and her pulse became weaker. She died an hour after a full meal had been given to her against orders by another patient. Her relations refused to allow a post-mortem. Death, in my opinion, was due to an overdose of salvarsan (arsenical poisoning). In the light of further experience, I consider that ·2 gram would have been a suitable dose to start with.

Other failures.—1. Serial No. 27, adult male Indian, with typical syphilis: This man on 22nd September, 1911, was given ·4 gram subcutaneously. On the 1st October, he was apparently cured, and he was given ·3 gram subcutaneously and discharged. On the 19th November, he returned with syphilitic ulceration of nasal septum. On December 10th the salvarsan was removed by incision from both injection areas. That of the 22nd September, 1911, was cheesy and whitish-yellow in appearance. That of the 1st October was of amber-yellow colour, and was fluid and transparent.

2. Serial No. 29, an old Fijian woman, with yaws (tertiary) of the nose and palate and a deep excavated ulcer of the side of the tongue; probably in part due to a decayed molar tooth. At the junction of her palate and right pillar of fauces there was a soft villous tumour which bled readily on touch. There were many old healed yaws lesions. Voice hoarse and weak; breath foul. September 28th, Pot. iod. grs. 10, t.d.s. and gargle pot. chlorat. September, ·2 gram salvarsan intravenously; half an hour later a rigor. October 14th, general condition better; breath less foul, voice stronger; ulcer smaller and cleaner; nose well. ·3 gram intramuscularly. November 8th, patient left at her own request. Ulcer and growth cleaner and slightly smaller. General condition better. This may have been a carcinomatous condition supervening on chronic yaws irritation.

3. Serial case 23, an Indian youth, with secondary syphilis and phthisis. On October 7th he was given ʒ j of serum subcutaneously. The serum was taken by blister from two cases of yaws which cleared up quickly after intravenous followed by intramuscular exhibition of salvarsan over a week previously. No general improvement was noted, though the rash and sore throat had cleared up by October 30th. This must be classed as a doubtful result.

4. Serial case No. 32, adult female Fijian, for two years had had tertiary yaws, ulcers of toe, thumb, and dorsum of hand. Admitted on October 2nd. October 5th, ʒ ij serum from two patients treated by intravenous followed by intramuscular or subcutaneous salvarsan six days after their intramuscular or subcutaneous injections. October 12th, no improvement; October 14th, serum ʒ ij from a patient treated intravenously on September 29th and October 9th. October 20th, no improvement, Pot. iod. grs. x. t.d.s. November 3rd, almost healed. Discharged with Pot. iod. to take home.

Bad after-effects.—1. Out of the twenty-three patients treated by intramuscular injections, all felt slight pain for twenty-four hours, none developed abscess. Two complained of pain lasting several days without disappearance of the tumour. This was in each case cut down upon and a little precipitated salvarsan was seen escaping in the blood. There was a condition of the muscle apparently of aseptic necrosis. The wound healed in a few days and all pain and discomfort vanished with a steady improvement in their symptoms of yaws and syphilis, respectively. Subsequently they each received another intramuscular injection which was well absorbed.

2. Of the six patients treated subcutaneously alone, all complained of slight pain. In one boy with yaws the tumour caused by injection remained for over a fortnight, but his yaws symptoms were ameliorated and completely cleared up after his second dose.

In serial case No. 2 (see other failures), the salvarsan was removed by incision. No signs of inflammation were present, and only slight pain.

3. Intravenous (sometimes followed by intramuscular or subcutaneous) injections.

(*a*) Of the cases of syphilis treated in this way all were Indians. One had temperature 101° on the night of injection, but it was normal next morning and after. He felt well throughout; the other two felt no discomfort, and presented no untoward symptoms.

(*b*) Of the 16 cases of yaws so treated, 10 were Fijians. There was one death, described above. Three suffered from rigors and rise of temperature shortly after injection, and of these three one had a transient albuminuria during the first 24 hours. One other had temperature 101°, with one-sixth albumen in her urine for five days. That is to say, three of the Fijian patients (of whom one died) developed albuminuria. The other seven patients felt well all through. The one European so treated had a rigor and rise of temperature (*circa* 101°) for three days, but no albuminuria. Of the three Indians with yaws so treated, all felt well; but one had a temperature up to 102°, and albuminuria for two days.

The Samoans and half-castes so treated developed no untoward symptoms.

With the exception of the woman who died, and of the four cases mentioned above under the heading " Other failures," and of the Indian with cerebral syphilis, who, up to the present date, is only slightly improved, all the cases treated with salvarsan were successful in so far as their symptoms disappeared and they expressed the opinion that they were now cured and now felt well. But no serum reactions were done.

Examples of Successful Cases.

1. Serial No. 23.—Adult male European (aged *circa* 57), the subject of tertiary yaws lesions. For over fifty years he had had very chronic yaws ulceration of his right hand for which he had frequently been treated with Pot. iod. and appropriate local treatment (such as scraping, &c.). He had been treated more times than he could remember, but without avail, as the ulceration had never healed during the last fifty years. For two months he had had two raised granulomata of face, and for one month a rapidly excavating phagademic-like ulcer of penis. He suffered from marked chronic nephritis (urine, sp. gr. 1006, no albumen; had to get up five or six times a night to pass water). On the 5th September, 1911, he was given ·3 gram salvarsan by intravenous injection; three-quarters of an hour later he had a rigor; temperature 102°, p. 110, no albuminuria. Subcutaneous saline, three pints, milk diet, saline purges. On the 6th September, temperature 99·8°; pulse 86; no albuminuria. Later: temperature 102·6°; pulse 104. Infused three pints; no albuminuria. On the 8th September, temperature normal, pulse 64. His condition all along was excellent. At once a change was noticed in the patient; his intense cachexia rapidly disappeared; he became cheerful, and expressed himself as feeling much better. On the 10th September, all ulcers almost healed. On the 11th September, salvarsan, ·3 gram subcut. On the 20th September, ulcer of hand healed for the first time for fifty years. The patient is a different man from what he was before treatment. He has put on weight, he looks healthy, and feels better than he ever remembers feeling in his life. He has only to get up once or twice a night to pass water.

2. Serial case No. 1.—An adult male Indian with tertiary syphilis, admitted on June 30th with multiple gumatous periostitis of lower ends of femora and tibiæ; the bones being much thickened and very heavy.

Right wrist and lower end of radius.—The hand was quite useless. The wrist joint was swollen, painful, and incapable of any movement. There were two circular ulcers on skin of dorsal surface of the lower end of radius, but the most marked symptom was the misery and cachexia of the patient. He was a picture of hopeless misery. Up till July 26th Hg. and KI had been given in large doses. From July 26th to August 4th passive congestion treatment of right wrist and hand was started as well as the Hg. and KI. There was slight improvement with the passive congestion. On the 4th August, he was given ·6 gram salvarsan intravenously. No unpleasant after effects were noted, though on the night of 4th August, his pulse was 120. On the 7th August the patient could move the fingers of his right hand. There is a marked improvement in his general health. He walks about the ward and talks to other patients, which he was quite unable to do before. On the 10th August, intramuscular injection of ·3 gram salvarsan. On the 12th August ulcers healed. On the 14th August, apparent cure of all active disease. On the 21st August, anæmia and cachexia cured. Weight obviously much increased. Complete use of the right hand recovered, though it is still slightly weaker than left. Discharged.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

3. Serial case No. 2.—An Indian boy, aged about eight years, was admitted to hospital on October 13th, 1910, suffering from multiple superficial granulomata due to yaws. For nine months he was treated in hospital with KI and other drugs and with appropriate local treatment. His condition improved not at all or very little. On August 4th, 1911, he was circumcised to remove various granulomata of prepuce. On August 7th his condition was as follows: There were many partially healed granulomata still present on his back, thighs, penis, and buttocks. They projected well above the surface, had a callous, yellowish appearance. Some were surmounted by thick yellow crusts. ·3 gram of salvarsan was given intravenously. No bad after effects. On 11th August, marked improvement, sores almost dry. On 14th August, apparent cure. Discharge. On the 6th December, the boy is still quite well; has gained weight, and is much healthier in every way. Has no sign of disease. Does a hard day's work from sunrise to after sunset.

4. Serial case No. 34.—A middle-aged Indian, extremely weak and cachetic; known for some years at the hospital as a sufferer from yaws; nostrils flattened and bound down to cheeks by raised granulomatous masses. Septum completely eroded in front, superficial ulceration of floor of nose. Superficial ulceration of hard and soft palate, both pillars of fauces and of buccal surfaces of cheeks. Intense pain on attempting to open his mouth. Urine contains no ulbumen. On 17th October, 1911, ·4 gram salvarsan intravenously; one hour later rigors. On 18th October, pulse 130, temperature 103°, urine albumen one-sixteenth. He was purged, put on milk diet, and infused five pints in 24 hours. On 19th October, general condition much the same. The lesions of nose and mouth are undergoing an intense hæmorrhagic change, with much swelling. Treatment continued as above. On 20th October, much better; temperature normal, pulse 104; lesions of nose and mouth are replaced by clean ulcers with healthy bases and edges. On 1st November, apparent cure. On 6th December, has gained much weight. Re-admitted to hospital for cicatricial condition of nose and mouth (can only open mouth one inch).

5. Serial case No. 35.—A six-year-old Wallis Island boy, admitted on the 13th October, 1911, with most intense secondary yaws eruption, erythematous papular and granulomatous (chiefly granulomatous) of whole body. There was not a square inch of healthy skin. A subacute conjunctivitis and coryza. On 14th October, ·3 gram salvarsan intramuscularly. On 16th October, great improvement. No conjunctivitis or coryza. On 18th October, almost complete cure; removed to Tonga by his relatives.

6. Serial case No. 30.—Female adult Fijian, with superficial butterfly ulceration of skin of face and nose. Nasal septum and palate extensively ulcerated. Very offensive copious nasal discharge, *i.e.*, tertiary yaws rhinitis. September 29th, ·4 gram salvarsan intravenously; half-hour later rigors. Milk diet. October 9th, practically cured. ·3 gram salvarsan intramuscularly. October 14th, apparent cure.

7. Serial No. 23.—A male Fijian youth, admitted on the 9th September with healed ulceration of palate—his uvula having completely gone. For three years he has had a periosteal swelling (the size of a hen's egg) of manubrium sterni and right upper costal cartilages. A sinus leads down to manubrium from surface. For seven months he has had a large granulomatous tumour on the surface of and movable only with the patella. For seven months he has had a hard swelling on dorsal surface of the three inner right metacarpal bones. This tumour is of about the size of half a billiard ball. On the 10th September, 1911, Pot. iod. grs. 5 t.d.s., hot foments to knee. On 11th September, salvarsan, ·4 gram subcutaneously. On the 9th September, marked softening of metacarpal tumours. On the 13th September, fluctuation in metacarpal tumours. On 22nd September, all lesions much improved; knee almost healed; general appearance much improved. On 4th October, hand and knee completely well. Tumour of manubrium much smaller though there is still a very slight discharge from sinus.

Conclusions.

1. The drug did not appear to have a selective influence on any of the races treated. The greater liability of Fijians to albuminuria following intravenous injection is only apparent, and is, in my opinion, due to the fact that yaws is a more

severe disease than syphilis. But no observations were made on the effect of salvarsan on the filaria. One of the Fijians, however, who did not develop albuminuria after intravenous salvarsan, was the subject of filarial elephantiasis.

2. Local treatment of yaws granulomata and ulcers by scraping, &c., is not called for, as the unhealthy protuberant granulations at once break down, to be replaced by healthy red healing granulations. Graft operations and excision of the scars left after the healing of ulcers of many years' duration are useful in some cases.

3. Local reaction was severe only in one case—serial case No. 34.

4. The best results were obtained by the intravenous method. The intramuscular is preferable to the subcutaneous method.

5. The results of treatment by serum from blisters obtained on treated patients are doubtful, and the method was only tried when the debility or age of the patient was considered a contra-indication to intravenous injection.

6. The treatment of yaws by salvarsan is our most economical line of treatment. In January and February, 1911, before salvarsan was used the average stay in hospital of yaws patients was over 45 days, although this includes several minor cases who were in only a day or two. The average stay in hospital of yaws patients treated salvarsan will be under 20 days, probably under 18 days.

7. Cases which were hopeless of cure when treated by other methods were apparently cured when treated by salvarsan.

* * * * * * *

Enclosure 2 in No. 5.

Hon. Colonial Secretary,

Detached accordingly.

I should like to say that we have for some time been using salvarsan at the Colonial Hospital and some other hospitals. A report on a series of cases is included in the Annual Medical Report now in the printer's hands.

There is no question that in some cases there is grave risk in the use of the drug, and we have had bad results in one or two instances; its employment must be most cautious, and cannot be indiscriminate.

G. W. A. Lynch.

29 August, 1912.

No. 6.

FIJI.

The GOVERNOR to the SECRETARY OF STATE.

(Received 27 January, 1913.)

Government House, Suva, Fiji,
21st December, 1912.

Sir,

With reference to Lord Elgin's Circular despatch of the 6th June, 1906,* I have the honour to forward, for transmission to the Advisory Committee of the Tropical Diseases Research Fund, a letter from the Chief Medical Officer, enclosing two reports by the Medical Officer of Health, Suva, a report by the Veterinary Surgeon, a report by the Acting District Medical Officer, Rewa, and a copy of the Annual Medical Report, 1911.†

I have, &c.,
BICKHAM ESCOTT,
Governor.

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* See page 7 of [Cd. 3992], March, 1908.

† Not reprinted.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Enclosure in No. 6.

The Chief Medical Officer to the Honourable the Colonial Secretary.

Subject :—*Forwarding Reports* (4) *for Advisory Committee for the Tropical Diseases Research Fund.*

I have to forward herewith, for enclosure in the next Report of the Advisory Committee for the Tropical Diseases Research Fund, three (3) reports :—

1. By the Medical Officer of Health (Dr. A. E. Ireland), on the examination of certain specimens of rice.

2. By the Medical Officer of Health (Dr. A. E. Ireland), and the Veterinary Surgeon (P. L. Edward, Esquire), on an obscure disease in mules.

3. A report by the Acting District Medical Officer, Rewa (Dr. P. T. Harper), on the treatment of a series of cases of yaws and syphilis by salvarsan, to which is appended a supplementary report of the further treatment of such cases.

4. I enclose also a copy of the Annual Medical Report for 1911.* I am obliged to do this because pressure of work has prevented my drawing up a report similar to that on page 68 of the enclosed report (Cd. 6024). Moreover, it will be seen that there is no malaria in Fiji, and that a great many of the statistics asked for are contained in the " Fiji Annual Report."

G. W. L. Lynch,
Chief Medical Officer.

19th November, 1912.

Report on nine samples of Rice submitted for examination, 9 September, 1911.

I have to report that I have examined these samples of rice, nine in number, and which consisted of the following :—

(*a*) Paddy;
(*b*) Paddy;
(*c*) Paddy;
(*d*) White broken;
(*e*) Siam;
(*f*) Seeta;
(*g*) Ballam;
(*h*) Chinese;
(*i*) Dressed;

(*a*), (*b*) and (*c*) were unhusked and were grown locally; (*d*), (*e*), (*f*), (*g*), (*h*) and (*i*) were imported, and with the exception of (*g*) were polished; (*g*) was unpolished; (*e*) (Siam) was the most highly polished.

On perusal of the report of Drs. Fraser and Stanton, it will be seen that the incidence of beri-beri depends upon the consumption of a staple diet of polished rice, and that in the sub-pericarpal layer of the grain there resides a substance the ingestion of which prevents the onset of beri-beri.

In the process of polishing the grain is more or less denuded of its pericarpal and sub-pericarpal layers, and the amount of this denudation will depend upon the extent to which the grain is polished.

In the more highly-polished samples the grain will be found to have lost its pericarpal and the whole of its sub-pericarpal layers; those not so highly polished may still show part of the sub-pericarpal layers; while those less polished still may show the sub-pericarpal layer intact, and some of the pericarpal layer may be left.

The following process was therefore carried out, in order to ascertain how far the different samples had been denuded of their sub-supercarpal layer.

The grains were first placed in carbolic mucilage acacia and allowed to soak for three months in order to soften them. They were then cleared by immersion in cedar oil for forty-eight hours, imbedded in paraffin, and sections cut and mounted on albumen-coated slides.

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* Not reprinted.

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The sections were stained with the following stains :—

(1.) Gram.
(2.) Hæmatein.
(3.) Sudan 111.
(4.) Osmic acid.

The Sudan 111 gave excellent results using a 0·5 per cent. alcoholic solution. Hæmatein also gave beautiful slides using a 0·5 per cent. alcoholic solution. Sections of (*a*), (*b*), (*c*), and (*g*) showed pericarp and sub-pericarpal layer intact.

In the polished samples the pericarp was absent.

In the (*h*) and (*i*) the sub-pericarpal layer was present.

In (*d*), (*e*), and (*f*) the sub-pericarpal layer was partly removed.

(*e*) Siam rice was the most denuded and showed little of the sub-pericarpal layer left.

Sample (*g*) was unpolished and showed both the pericarp and the sub-pericarp intact.

The consumption of samples (*a*), (*b*), (*c*), and (*g*), in which the pericarp is intact, as a staple diet could not give rise to the outbreak of beri-beri. Samples (*h*) and (*i*), inasmuch as they retain their sub-pericarpal layer intact, are harmless.

The consumption of samples (*d*), (*e*), and (*f*), however, in which the sub-pericarp is wholly or partly removed, would be likely to give rise to an outbreak were the rice used as a staple diet.

These rices are all in daily use as food by the different classes of Indian immigrants in this Colony. No case of beri-beri, however, so far as I am aware, has arisen amongst them, and this I attribute to their invariable practice of eating dhal with their rice.

Archibald Ireland.

May 18th, 1912.

The Veterinary Surgeon to the Honourable the Chief Medical Officer.

Subject :—*Disease of Stock at Naselai.*

I beg to report that I have investigated an outbreak of a disease at Naselai, Rewa. The outbreak has not yet finished, but as I consider the disease very highly contagious, both by mediate and immediate contagion, I consider that the best thing to do would be to shoot all the remaining infected animals and to disinfect all buildings, &c. If the remaining six mules are shot and a post-mortem examination made, more may be ascertained about the pathology of the disease, as up to now only four post-mortem examinations have been made.

This is due to the fact that I have had to work under rather disadvantageous circumstances :—

(1.) The distance and time taken in the journey from Suva to Naselai—Naselai is 15 miles from Suva, and the journey takes three to three and a half hours.
(2.) I have had other duties to perform in Suva and elsewhere, and could not always visit Naselai when I wished.
(3.) During the investigations I have had to leave the district three times for a period in all of six weeks.

On August 18th I was called in to attend five mules at Naselai. I found them all suffering from a lymphangitis of one or more legs. There was also cording of the lymphatics. These abscesses appeared cold and painless; they were nodular and freely movable under the skin and hard, very much resembling small subcutaneous fibromata. A very small percentage of them had burst and were discharging a small amount of thickish white pus (consistency of cream). Some of these abscesses showed signs of healing. The size varied from the size of a pea to that of a hen's egg. They were situated on the inside of the thighs and hocks.

Two of these mules had a profuse blood-stained tenacious discharge from both nostrils, and ulcers the size of two-shilling pieces were found both on the septum and other parts of the nasal mucous membrane. There was not any adenitis of the

submaxillary glands. The temperature was slightly raised, being between 102° and 103°. All the mules were eating well and showed no signs of depression. The lymphangitis was not very pronounced, moderately painful, and the mules were fairly lame. Swellings were also present on the abdominal walls.

As it was thought that this might be an outbreak of glanders, these mules were malleined (Cutter Laboratory Mallein, Berkeley, United States of America), but did not react. There was only one local swelling three inches by two inches at its maximum. This was painless, and disappeared in thirty hours. None of the mules showed any systemic disturbance.

Smears of pus from an unbroken abscess were then examined for the "cryptococcus of rivolta," but it was not present.

These mules were then isolated at one end of the stable, the best that could be done, as there was then only one stable on the estate, but an isolation stable has since been built.

On August 20th two mules were suffering from laryngitis, and on 24th tracheotomy was performed on three mules, one more having developed laryngitis in the interval.

On September 4th a mule died and a post-mortem examination was made. Gangrenous pneumonia affecting both lungs was found, but no nodules. There was also extensive ulceration of the mucous membrane of the nose and bones, and the septum nasi was ulcerated through the hole, one and a half by one inches. There was extensive ulceration of the larynx. The facial sinuses were healthy and there was no ulceration of the trachea.

The lymphangitis was due to the usual straw-coloured exudate; the subcutaneous abscesses had very thick walls half to one inch thick and contained a small suppurating centre, the pus being thick.

I have only been able to make three other post-mortem examinations, and in these mules I have found the same lesions, with the exception of gangrenous pneumonia. In two cases small abscesses were found in the lungs. Also abscesses in the pharyngeal and mesenteric glands.

Thirteen mules have died and six are now affected. No mule that has once shown symptoms of the disease has made a permanent recovery. Four mules have made apparent recovery, but all have had a relapse and three are already dead.

(1.)—Chestnut female mule showed in October lymphangitis and abscess on near foreleg, recovered and remained apparently healthy three months.

(2.)—Brown mule gelding, lymphangitis of head by abscess on scrotum, remained apparently healthy two months.

(3) and (4.)—These mules only remained apparently healthy for two weeks.

This estate was absolutely free from disease for a fortnight in October last. At the end of that period it again broke out. The longest period that the stud has remained free, after isolation of all affected animals in a separate stable, is three weeks, but I do not pay much attention to this, as where Indian labour is employed on a small estate absolute strict isolation is practically impossible.

A vaccine was prepared, and on November 19th all mules on the estate received a subcutaneous injection of circa 360 million bacteria, and the sick two further doses of 260 million at intervals of five days. On February 19th all the mules received a further injection of 720 million. Since the preparation of the vaccine all the diseased mules have received three doses of vaccine at intervals of five days whenever possible.

Since the introduction of the vaccine the course has become far less acute. At the beginning death occurred in twenty-one to twenty-eight days, now death never occurs in less than seven weeks, often longer. Whether this is due to the vaccine or not I am not prepared to say, but I regret that I was not able to use the vaccine more regularly in all cases. The lesions in nose do not progress half so rapidly, and the nasal ulcers are smaller in size, being of the size of one shilling and a few the size of sixpence. The first symptoms are usually those described in the four mules. The next that is seen is laryngitis. This occurs after a variable period of about three days to three or five weeks. Swollen lymphatics, subcutaneous abscesses make their appearance all over the body. These abscesses show no great tendency to burst, only about 15 per cent. breaking naturally. They discharge for a few days

and heal up in about ten days. This is a very short time for healing in this country, where wounds take 100 per cent. longer to heal than in Great Britain. Many of these abscesses become re-absorbed without breaking. If lanced, they will often heal up before all the pus has been evacuated, and a secondary abscess sometimes forms.

The septum is usually perforated by the ulcers in ten to thirty days. I do not think that these large ulcers are formed by the anastomosis of smaller ones. The sub-maxillary gland when swollen usually shows three or four large nodules, and it is never firmly attached to the ramus of the jaw, being freely movable, and in about 20 per cent. of cases it suppurates. This lesion is not always present when there are lesions in the nose, but it is present fairly often—about 50 per cent. The size of the gland also bears relation to the extent of the lesions in the nose, very often the sub-maxillary swelling is on the opposite side of the nasal ulcers, and though towards the end the nasal lesions are bilateral, the sub-maxillary swelling remains very often unilateral.

The final stage is pneumonia, shortly followed by death.

I find that this disease is also present in the Nadi district. In February, 1911, I was called in to investigate an alleged outbreak of glanders on Mr. Harrick's plantation there. On my arrival I found that there had been two suspicious cases, one mule having died before my arrival, the second mule was alive, and after a careful examination, I came to the conclusion that it was perfectly healthy. On my questioning the stockman, he told me the symptoms shown by the dead mule, and I am convinced that the mule died from this disease. Another outbreak was reported on this estate in October last—two mules were malleined by the stockman. One was said to have reacted. On my arrival I found that the mule that was said to be a reaction was the mule that had been regarded by them as suspicious in February. He had, however, remained apparently healthy, and appeared quite healthy when I saw him. I found that the reaction was based on local swelling, but that the mallein had been injected at the lower edge of the mane, just in front of the withers, and naturally a swelling had occurred. This lasted 203 days only. The mule is still healthy and at work.

The second case, said not to have reacted, was a four-year-old mule, who was a perfectly typical case of this disease. This mule died three weeks after I saw it. Since then there has not been another case on this plantation.

I find that these two mules at Nadi and the mules that first showed signs of disease at Naselai arrived in Fiji from United States of America in S.S. "Waitematu," August, 1910, and before being shipped were malleined by Mr. P. Egan, M.R.C.V.S., of San Francisco.

Photographs* of a typical case are enclosed.

I beg, in conclusion, to point out, in my opinion, the main differences between this disease and glanders:—

(*a*) Abscesses do not tend to burst, and, having burst, quickly heal.
(*b*) The large amount of fibrous tissue wall and small suppurating centre.
(*c*) Large size of nasal ulcers, and rapid rate at which ulceration proceeds.
(*d*) The large number of cases in which the submaxillary gland suppurates.
(*e*) Absence of nodules in lungs.

P. Laurence Edward,
M.R.C.V.S.

March 12, 1912.

Report on the Bacteriology of a Disease affecting Mules in the Rewa District.

On the 3rd of November, 1911, at the request of the Veterinary Surgeon, I visited the estate of Naselai, near Nausori, in company with him.

Some of the mules on this estate were suffering from a disease simulating in some of its clinical features glanders. The most striking and constant lesions were ulceration of the nasal mucous membrane and superficial abscesses about the neck and upper parts of the legs.

* Not reproduced.

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I inoculated the following tubes :—

(*a*) Glycerine potato—from nasal mucous membrane;
(*b*) Glycerine potato—from small abscess in neck;
(*c*) Agar-agar slope—from small abscess in neck;

all from the same animal, which presented well-marked lesions.

They were incubated at 37° C., as were all cultures used in this investigation.

Tube (*a*) in forty-eight hours presented a luxuriant mixed growth. The surface of the potato was covered with a creamy custard-like growth, very profuse, and spreading on to the sides of the tube. There were also a few discrete round, white colonies, one large orange-yellow colony, and one large brown one.

The white colonies gave a Gram-positive staphylococcus, as also did the orange-yellow one.

The brown colony proved to be a long, narrow, club-shaped bacillus, showing marked unipolar staining with methylene blue; it was in fact a chromogenic organism.

The organism producing the main custard-like growth was a small bacillus with rounded ends, staining somewhat faintly with methylene blue, and Gram-positive, though not deeply stained by this method.

Tube (*b*) in forty-eight hours showed a small discrete golden-yellow growth. Slides from this culture showed a small bacillus with rounded ends, staining faintly with methylene blue and not decolorised by Gram's method, though not deeply stained. This bacillus was in pure culture in this tube.

Tube (*c*) in forty-eight hours gave a number of small discrete whitish colonies, the organism comprising which, and which was in pure culture, was a small bacillus with the same morphology and staining reactions as the bacillus described above as occurring in the custard-like growth of tube (*a*) and in the pure culture of tube (*b*).

Thus a bacillus was obtained from the lesions, in pure culture in tubes (*b*) and (*c*), and from the custard-like growth of tube (*a*), having the same morphology and staining reactions.

Subcultures.—A series of subcultures was made from the custard-like growth of tube (*a*) and from tubes (*b*) and (*c*), inoculating them from potato to agar and from agar to potato alternately, and a pure strain of a bacillus thus obtained in each instance.

The bacillus thus isolated was identical in size, morphology, staining reactions, and culture characteristics in all three series.

Description.

It is a small, slender bacillus, with rounded ends, showing beading of the protoplasm. It was of uniform size in all the cultures, being in length two to three p. (about the size of *B. Typhosus* in young culture). No involution forms were seen. It stained somewhat faintly with methylene blue, and was not decolorised by Gram's method, though staining but faintly.

Cultural Characteristics.

Glycerine potato, in twenty-four hours, a small, creamy growth, slightly yellow, more abundant in forty-eight hours, and becoming a darker brownish-yellow in seventy-two hours, and gradually turning to a chocolate colour in three weeks.

On agar slope, in twenty-four hours, a semi-transparent whitish growth, not luxuriant, and with little tendency to spread. It became more opaque as it grew thicker, but no further change occurred in it.

Glucose-litmus agar (stab) in twenty-four hours showed no growth, but in three days a little whitish growth showed in the upper part of the needle track, with slight acid production, but no gas

Vaccine.

On the 8th November a vaccine was prepared from culture tube (*c*) after it had been re-examined and found uncontaminated. An emulsion was made, 10 cc.

of which contained 360 million bacilli, using normal salt solution with 0·25 per cent. lysol. The emulsion was then placed in the hot-water oven at 60° C. for one hour.

On the 9th of November the mule from which the cultures were made was injected with 10 cc.—360 million bacilli, and on 14 November, 1911, a further dose of 720 million bacilli was given to the same animal.

The mule showed some improvement after the first injection, the abscesses resolved, and the pus formation ceased. It had, however, developed a septic pneumonia, of which it died on 20 November, 1911. Post-mortem :—No pus was found in the swellings about the neck and legs.

On 17 November, 1911, 19 further mules were injected with the same vaccine, giving 360 million bacilli to each. Of these, five were affected with the disease.

On 21 November, 1911, one more animal received a dose of 360 million.

The Veterinary Surgeon reported 21 November, 1911, that after the injection of the vaccine—

(1) the pus in the abscesses showed a marked tendency to dry up, and that local swellings disappeared;
(2) the ulceration of the mucous membrane was retarded;
(3) the laryngitis remained unaltered.

Inoculation of Animals.

The following experiments were carried out :—

On 15 November, 1911, two guinea-pigs, X and Y, were inoculated with emulsion from Tube R (agar), subculture third from B.

X, a female, intra-peritoneally.

Y, a male, by scarification (right hind leg).

X was unaffected and is now alive and well. Y died on the eighth day.

Post-mortem :—This guinea-pig, Y, showed the following lesions—the seat of scarification was normal, and there were no enlarged glands. The liver, spleen, and kidneys were normal. There was pneumonia of the left lung, and the suprarenals were both red and engorged, especially the left. Both testicles were found in the abdomen and slightly enlarged, and both epididymi were dark red and engorged.

The following cultures were made, using agar-agar slopes, from—

(*a*) heart blood;
(*b*) left lung;
(*c*) suprarenal;
(*d*) testicle.

Each of these four tubes gave a growth identical with the growth on agar of the original bacillus isolated from the mule, and subcultures on potato and glucose-litmus agar grew in a precisely similar manner to the growth on these media of the original organism.

The four cultures (*a*), (*b*), (*c*), (*d*) were pure, and showed a bacillus having the size, morphology, and staining reactions of that organism, as did also all the subcultures.

It gives the indole reaction in a seven days' broth culture. It does not stain with osmic acid or with Sudan 111.

On 24 November 1911, a further guinea-pig was inoculated subcutaneously with emulsion from subculture V. (agar—third from B). This guinea-pig, Z, lived for seventy-five days and then died. No obvious lesions were present, and the cause of death was not apparent.

On 2 December, 1911, a horse was inoculated with an emulsion from an agar subculture, second from (*d*) guinea-pig. This horse died on the eleventh day. Post-mortem :—There was found to be much swelling about the site of the injection, which was subcutaneous, and there were small abscesses in the subcutaneous tissue in this situation (the near fore-leg), and there were also small abscesses in the lungs and liver. Early peritonitis, with some ascites, was also present.

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Unfortunately, I was unable to obtain cultures from this animal. The conclusions to be drawn from these investigations are :—

That the bacillus isolated, and which it is reasonable to suppose is the cause of the disease, although resembling *B. Mallei* in some respects, is certainly not identical with it.

The differences shown are in :—

A. *Morphology.*—The bacillus isolated is smaller than *B. Mallei.*

B. *Cultural characteristics.*—The growth on potato was very considerably different to that of *B. Mallei.* The growth was much more rapid, giving a creamy growth in twenty-four hours, whereas *B. Mallei* is seldom distinguishable in culture till the third day, and is then seen as clear yellow drops like honey, and this is commonly regarded as characteristic of *B. Mallei* and peculiar to it.

The growth on agar never became brown as does that of *B. Mallei.*

C. *Staining reactions.*—The bacillus isolated was consistently Gram-positive, whereas *B. Mallei* is easily decolorised by this method.

With regard to the inoculation experiments, it is greatly to be regretted that a mule could not be obtained for this purpose, as the disease has so far been confined to those animals, and horses, although exposed to infection and using the same stables, have escaped infection with the disease.

The recovery of the organism from the testicles of guinea-pig Y, and the fact that they were infected, as were the epididymi, perhaps points to an organism allied to *B. Mallei.* The death of the animal on the eighth day, however, and the death of the horse on the eleventh day, do not correspond with the usual results of inoculation with *B. Mallei.*

Finally, I think from a consideration of the above data we may conclude that although the bacillus isolated is not *B. Mallei,* it may be regarded as belonging to a closely allied group.

Archibald Ireland,
M.R.C.S., & R.C.P., D.P.H., Oxon.,
Medical Officer of Health,
Suja, Fiji.

Report on the Treatment of Fijian Yaws and Syphilis in Indians by 606 in 1911, by P. T. Harper, Resident Medical Superintendent, Colonial Hospital.

[*See Enclosure in No.* 5.]

Yaws.

Case No.	Nationality.	Lesions.	Treatment.	Result.
Case 2	Indian	Multiple superficial granulomata.	Treated with KI and other drugs, and by local treatment for over 9 months, 7 August, 1911. Salvarsan, ·3 gram intravenously.	Very slight, if any, improvement. Cured, 14 August, 1911.
„ 3	„	Yaws ulceration of nail-bed of fingers and toes.	Treated for 1 month with KI and local measures. Salvarsan, ·3 gram intravenously, 7 August, 1911. Salvarsan, ·3 gram intramuscularly, 10 August, 1911.	No improvement. Apparent cure, 21 August, 1911.
„ 4	Samoan	Scarring of legs from old yaws, periostitis of tibia, 9 months' history of raised granulomatous ulcers of legs, very callous looking.	Had taken KI unavailingly for several months. ·6 gram intravenously on 7 August, 1911 (salvarsan).	Apparent cure, 21 August, 1911.

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REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Case No.	Nationality.	Lesions.	Treatment.	Result.
Case 6	Fijian	A tertiary ulcer of bend of arm of about the size of palm of hand. Says she has had it 4 months. Pale yellowish base.	Salvarsan, ·6 gram intravenously.	Rigor, temp. 10 days later the ulcer had the appearance of having been carefully scraped, healthy red base with sloping edges. 1 month after injection, the ulcer was healed. Apparent cure.
„ 7	Half-caste Fijian-European.	5 years' history of tertiary yaws ulceration of arms and legs. The ulcers had probably existed much longer. Very many callous pale ulcers with hard raised edges all over front of shins and arms.	Salvarsan, ·6 gram intramuscularly, ·2 gram subcutaneously.	Apparent cure.
„ 8	Fijian	Tertiary yaws ulcers of breast and throat.	Salvarsan, ·6 gram intravenously.	9 days later the ulcers had the appearance of having been successfully scraped. Left hospital at her own request, 9 days later. Injection when the ulcers were healing well.
„ 12	„	Raised callous-looking ulcers of both hands, throat and pharynx.	Salvarsan, ·6 gram intramuscularly.	Apparent cure (13 days later).
„ 13	„	Tertiary ulcers of both arms and flank.	Salvarsan, ·6 gram intramuscularly, salvarsan, ·3 gram subcutaneously.	Slow progress. Almost healed after 35 days.
„ 14	„	Ulcer of right breast ...	Salvarsan, ·6 gram intravenously.	Death.
„ 17	Samoan (child).	Soki (very painful granuloma under skin of foot). Child looked cachetic and weak.	Salvarsan, ·1 gram intramuscularly, salvarsan, ·2 gram intramuscularly.	Apparent cure. Child's anaemia and weakness cured.
„ 18	Fijian	5 months' history of yaws ulceration of face.	Salvarsan, ·5 gram intramuscularly.	Apparent cure.
„ 19	„	Ulcer (size of 4 half-crowns) round ankle.	Pot. Iod. grs. t.d.s., ulcer scraped. Salvarsan, ·4 gram. subcutaneously. Salvarsan, ·3 gram subcutaneously.	Apparent cure
„ 21	„	Round excavated ulcer of under surface of ball of great toe, onychial ulcer of second toe.	Boracic baths. Salvarsan, ·4 gram subcutaneously.	Apparent cure
„ 22	European	Yaws ulceration of right hand which had not healed for 50 years. Yaws granulomata of face of 2 months' duration. Deep excavated ulcer of glans penis, 1 month.	Salvarsan, ·3 gram intravenously. Salvarsan, ·3 gram subcutaneously.	5 days later all ulcers almost healed, 15 days after first dose hand healed for first time for 50 years. Apparent cure.
„ 23	Fijian (child).	Periostitis of manubrium, costal cartilages, and metacarpal bones, sinus down to manubrium.	KI grs. t.d.s., and hot foments. Salvarsan, ·4 gram subcutaneously.	Apparent cure, but still a small sinus to manubrial swelling (secondary sepsis).
„ 24	Samoan (child).	Sokis of foot, raised granulomata of neck and arm.	Salvarsan, ·2 gram intramuscularly.	Apparent cure.
„ 25	„	Sokis of foot	Salvarsan ·2 gram intramuscularly.	Apparent cure.
„ 26	Fijian	Large ulcer of right arm (1 year), yaws nose, cachetic looking.	Salvarsan, ·4 gram intravenously. Salvarsan ·3 gram subcutaneously.	Apparent cure.

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REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Case No.	Nationality.	Lesions.	Treatment.	Result.
Case 28	Half-caste child, Fiji-European.	Yaws ulcer of soft palate and uvula.	Salvarsan, ·2 gram intravenously.	Apparent cure.
" 29	Fijian	Extensive ulceration of soft palate, at junction of right pillar of fauces a soft villous tumour (size of top of thumb), a deep cirrhotic ulcer of side of tongue, breath very offensive, voice hoarse and weak.	Salvarsan, ·2 gram intravenously. Pot. Iod. grs. 10 t.d.s., gargle pot. chlor. Salvarsan, ·3 gram intramuscularly.	Ulcer and growth smaller and cleaner, breath sweeter, voice stronger and clearer.
" 30	"	Superficial butterfly ulceration of skin of nose and face, extensive ulceration of nasal septum and palate; very offensive and copious nasal discharge.	Salvarsan, ·4 gram intravenously. Salvarsan, ·3 gram intramuscularly.	Apparent cure 10 days after first dose.
" 31	"	Similar to case 30, but not so severe.	Salvarsan, ·3 gram subcutaneously. Mist. Pot. Iod. grs. 10 t.d.s. Salvarsan, ·3 gram intramuscularly.	Apparent cure 12 days after first dose.
" 32	"	Two years' callous ulcer of dorsum of hand and toe. Quoted under Failures.	Serum from treated patients. Pot. Iod.	Improvement. Failure.
" 34	Indian	Ulceration of nose, mouth and palate, which absolutely resisted other treatment.	Salvarsan, ·4 gram intravenously. Salvarsan, ·3 gram intramuscularly.	Apparent cure.
" 35	Wallis Island boy.	Most extensive secondary yaws eruption.	Salvarsan, ·3 gram intramuscularly.	4 days later he had to catch the boat to Tonga. Was by then almost cured.
" 36	Fijian	Raised granulomata of breasts and flanks, four in number, about size of a penny piece.	Salvarsan, ·3 gram intramuscularly.	Apparent cure.
" 37	Samoan (child).	Yaws of skin, ulcers and granulomata.	Salvarsan, ·3 gram intramuscularly.	Apparent cure.
" 38	"	Soki and ulcer of skin of leg.	Salvarsan, ·2 gram intramuscularly.	Apparent cure.
" 39	"	Yaws ulcer of mouth, buttocks, anus, and abdomen.	Salvarsan, ·2 gram intramuscularly.	Apparent cure.
" 40	Fijian (child).	Yaws of nose and face ...	Salvarsan, ·3 gram intramuscularly.	Apparent cure (after 11 days).
" 42	Fijian	Yaws of heel of many years' duration; pieces of bone have come away at different times.	Pot. Iod. grs. 10 t.d.s. and scraping, 14 November, 1911. Salvarsan, ·3 gram intravenously, 18 November, 1911. Salvarsan, ·3 gram subcutaneously, 26 November, 1911. Graft operation, 3 December, 1911.	
" 43	Fijian boy	Yaws periostitis of left tibia ulcerating through skin. Many other tertiary ulcers.	Pot. Iod. grs. 5 t.d.s. hot foments, 8 November, 1911. Salvarsan, ·3 gram intravenously, 18 November, 1811. Salvarsan, ·3 gram intramuscularly, 24 November, 1911. Salvarsan, ·3 gram subcutaneously, 3 December, 1911.	
" 44	Fijian	Many tertiary ulcers of legs.	November 4, Pot. Iod. grs. 10, hot foments. November 18, Salvarsan, ·3 gram intramuscularly.	Gradual but very slow progress. Apparent cure 4 days after salvarsan.
" 46	"	Extensive ulceration of palate and nose, septum almost completely gone, and alae of nose and cheeks attacked.	Pot. Iod. grs. 5 t.d.s., 18 November, 1911. Salvarsan, ·3 gram intravenously, 21 November, 1911.	Apparent cure 1 week after salvarsan.

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Case No.	Nationality.	Lesions.	Treatment.	Result.
Case 47	Fijian	Tertiary ulcers of foot and trunk for 10 years.	November 15th, Pot. Iod. grs. 5 t.d.s. November 21st, salvarsan, ·3 gram intramuscularly.	November 28th, ulcers clearing up well.
„ 48	Indian	Yaws granulomata of face and trunk, papular rash, ulcer of penis.	November, Pot. Iod. grs. 5 t.d.s., salvarsan, ·6 gram intramuscularly. December 3rd., salvarsan, ·6 gram intramuscularly.	Apparent cure, December 4th.

Syphilis.

Case No.	Nationality.	Lesions.	Treatment.	Result.
Case 1	Indian	Periostitis, synovitis and dactylitis, ulcers (tertiary syphilis).	Hg and KI passive congestive treatment. Salvarsan, ·6 gram intravenously, ·3 gram intramuscularly.	Slight, if any, improvement. Apparent cure.
„ 5	„	Hard chancre, sore throat, rash, glandular enlargement (primary and secondary syphilis).	Salvarsan, ·6 gram intravenously.	Apparent cure (seen in street on 9th December, 1911. Has been quite well since discharge and has worked hard as a painter).
„ 9	„	Depressed bridge of nose, pain and tenderness over nose, discharge from nose (piece of dead bone having come away), leukoplakia of tongue (tertiary syphilis).	Salvarsan, ·6 gram intravenously.	Apparent cure.
„ 10	„	Sore throat, condylomata of scrotum and thigh, healing primary chancre (secondary syphilis).	Salvarsan, ·6 gram intravenously.	Apparent cure.
„ 11	„	Discharge from nose, pain over nose and face, depressed bridge, tenderness over bridge (tertiary syphilis).	Salvarsan, ·6 gram intramuscularly.	Apparent cure.
„ 15	Indian (child).	Nasal discharge, tenderness over bridge of nose, depressed bridge (congenital syphilis).	Salvarsan, ·6 gram intramuscularly.	Apparent cure.
„ 16	Indian	Primary chancre 1 year ago, sore throat, multiform rash, injected pharynx, bunch of condylomata round anus (secondary syphilis).	Salvarsan, ·6 gram intramuscularly. Salvarsan, ·3 gram subcutaneously. Not absorbed. Had to be removed on December 10th.	Apparent cure.
„ 20	„	Sore throat, papular rash, condylomata of scrotum and anus (secondary syphilis).	Salvarsan, ·4 gram subcutaneously.	Apparent cure.
„ 27	„	Primary chancre 9 months ago, sore throat, papular rash, general glandular enlargement (secondary syphilis).	Salvarsan, ·4 gram subcutaneously. Salvarsan, ·3 gram subcutaneously.	Recurrence (ulceration of nasal septum 3 months later).
„ 33	„	Sore throat, multiform rash, history of chancre, phthisis.	Salvarsan, serum ℥ ij subcutaneously.	Doubtful, rash and sore throat; got well.
„ 41	„	Depressed bridge of nose with sinus leading down to it, pieces of bone had been discharged, ulceration of interior of nostrils and septum.	℥ ij blister serum from case No. 34 (a yaws patient), taken 3 days after he had had ·4 gram subcutaneously. Salvarsan, ·3 gram subcutaneously.	Improvement. Apparent cure.

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Case No.	Nationality.	Lesions.	Treatment.	Result.
Case 45	Indian	History of a chancre, multiform rash, glandular enlargement (secondary syphilis).	Salvarsan, ·3 gram intramuscularly. Salvarsan, ·3 gram intramuscularly.	Apparent cure.
„ 49	„	Multiple ulcers of vagina and nymphae, coppery rash on chest, sore throat, pharynx and tonsils injected (secondary syphilis).	Hyd. c. cret. gr. 1 t.d.s. (November 10th). Salvarsan, ·6 gram intramuscularly (November 21st).	Apparent cure.
„ 50	„	Primary chancre, marked anaemia, wife and child in hospital with secondary syphilis. (Primary syphilis.)	Liq. Hydr. Perchlor. ʒ i t.d.s. (November 22nd). Salvarsan, ·2 gram intramuscularly (November 28th). Salvarsan, ·3 gram intramuscularly (December 1st). Salvarsan, ·3 gram subcutaneously (December 3rd).	No noticeable progress (28 November). Chancre healed, condition better. No other symptoms yet developed.
„ 51	„	Difficulty in speaking and swallowing, ptosis of right eye, spastic paraplegia of legs, leukoplakia of tongue (cerebral syphilis).	·6 gram intramuscularly (December 1st).	Improvement (December 5th); leukoplakia clearing, speaks and swallows better.

Sir, Nausori, Rewa, 14 October, 1912.

Fifteen months have now passed since I first, at your request, started to use salvarsan in the treatment of yaws and syphilis at the Colonial Hospital.

On January 1st of this year, I took over the temporary duties of District Medical Officer, Rewa, and from that time have had an opportunity of judging of the merits of the drug when used in the ordinary routine of a District Medical Officer's practice.

In addition, I have had an opportunity of seeing several of the patients whose treatment was described in the previous paper from me on this subject, which is about to be published in the Annual Report for the year 1911.

The seven Samoans treated in 1911 have been seen or heard of, and all are still well. The two half-castes (girls) are reported to have been still well about two months ago.

One of the Indians who was treated for secondary syphilis has been seen on two occasions, and was quite well when last seen.

Some of the Fijians and Indians have been heard of. They are reported as being still well.

The European is reported still to be well.

I have seen one Indian in whom, after apparent recovery, the yaws for which he was treated last year has reappeared, though in a much milder form than that with which he was previously affected. This man was Serial No. 34 of my previous report, *q. v.* He was instructed by me, as I was at the time without salvarsan at Nausori Hospital, to come again later on. He did not come and I have since lost sight of him.

We may take it, I think, that the ultimate results of the work done in 1911 are at least among the best of the results ever obtained in the treatment of yaws and syphilis.

Since the beginning of this year ten more cases of syphilis (including two of interstitial keratitis) and 21 cases of yaws (12 of secondary yaws and nine of tertiary yaws) have been treated with apparent success. A few other cases of tertiary yaws were treated, but no record of them was kept.

A case of true pernicious anæmia and a case of psoriasis were treated, but without benefit.

The cases of syphilis, as being in this instance of little or no importance to the life of a nation, merit no further discussion. The cases of tertiary yaws are of more importance, both because in these cases the disease has gravely affected the body of a Fijian, and because such cases are foci of infection to healthy subjects.

The cases of secondary yaws call for special comment. These comprised four adult Indians, one Indian child, and seven Fijian infants and children. With one exception, all appear to have been cured. The exception is an adult female Madrassi, who has returned to hospital with a slight recurrence of the disease. I have no doubt whatever that she will be cured.

Of the seven Fijian children, three at least would have died of the disease within a fortnight if left untreated on the usual lines.

It is no longer possible to doubt that an active campaign against yaws, if energetically carried out with the co-operation of all parties concerned, would wipe the disease out of the country.

In my opinion, if once the Fijians were rid of the yaws scourge, the death-rate from tuberculosis and dysentery (as well as from yaws and the paraframbœsial diseases) would show a very marked reduction. Besides this, the immense number of abortions and still-births which now occur among the native women as a result of pre-existing yaws would rapidly cease.

In other countries native races have died out in the past and are dying out to-day as a result of syphilis and of trypanosomiasis, both of which diseases are closely allied to yaws.

In the present state of our knowledge salvarsan is the only drug which is of the slightest use in the treatment of secondary yaws, the inevitable disease of the Fijian child.

The results of other observers and myself show that this drug, when properly given, effects an apparent cure in the vast majority of cases. Rightly used, this knowledge should be of inestimable value to the Fijian race, for it is on these lines that the first effectual steps can be taken to put an end to the decrease in the native population of Fiji.

I have, &c.,
Philip Harper,
Acting District Medical Officer.
Rewa.

The Honourable
Chief Medical Officer.

No. 7.

HONG KONG.

REPORT ON SPECIAL INVESTIGATIONS CARRIED OUT IN THE BACTERIOLOGICAL INSTITUTE AND IN THE PUBLIC MORTUARY, VICTORIA, DURING THE SIX MONTHS, JANUARY 1st TO JUNE 30th, 1913.

(Received in Colonial Office 29 September, 1913.)

An investigation of the mosquitoes of Hong Kong was commenced in July, 1912, and still continues.

(A.) Scope of the Investigation.

The work may be divided for practical purposes as follows :—

1. A search for the presence or absence of *Stegomyia fasciata;* the importance of this in view of the connection between *Stegomyia fasciata* and yellow fever need not be gone into here.
2. A collection of anopheline mosquitoes, with special reference to their exact distribution in the Colony. It is also hoped to work out which of these anophelines are malaria carriers.
3. A collection of culicines in general, in order that a definite record of the culicidæ of Hong Kong may be established and a representative collection of specimens got together and preserved in this Institute.

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(B.) Method of carrying out the work.

The investigation is being carried out almost entirely by the capture of larvæ and pupæ, and the subsequent breeding of them out. At the same time notes are made of the exact conditions under which the larvæ, &c., are taken, so that when completed it should be possible in most cases to say, on taking an adult mosquito, where that mosquito has bred from.

(C.) Assistance in carrying out the collection.

Owing to the numerous routine duties of my post of Bacteriologist and Medical Officer in Charge of the Victoria Mortuary, the time which I have to spare for this special work is never great and is liable to frequent necessary interruption. It would, therefore, have been impossible to have carried on any consecutive work without the special assistance detailed below :—

(1) An arrangement was made by which Inspector Watson agreed to give his spare time (*i.e.*, the time which he has free after his duties as Inspector of the Cattle Depôt and Slaughter Houses are finished) to the collection of larvæ, &c., from July 1st, 1912, to June 30th, 1913. The results of his visits in the city of Victoria in search of stegomyia are given below. In addition, he has made a most thorough search of the island for anophelines, and his remarkable skill in collecting anopheline larvæ was of the greatest value.

(2) The H.S.D. was good enough to give instructions that the sanitary staff should, in the course of their routine duties, inspect all houses for larvæ, and when larvæ were found that they should be sent to this Institute for examination by me. The number of visits and the results are given below.

(3) On the departure of Inspector Watson on leave to England, the Mafoo of this Institute was specially seconded as collector. He has carried out this work well, and it still continues.

(4) In the laboratory examination of the larvæ, pupæ, and adults, I have received much valuable assistance from Captain D. Arthur, M.B., I.M.S., who has been working in his spare time in the Institute for some considerable time.

The Stegomyia Survey of the city of Victoria.

The period covered is from 1st July, 1912, to June 30th, 1913, but as Inspector Watson alone was collecting in July, 1912, the results of the collection by the sanitary staff for July, 1913, have been included for comparative purposes.

The number of visits paid and the number of houses in which larvæ were found are shown on the attached tables (Tables I. and II.*), but they may be briefly summarised as follows :—

(A) Inspector Watson	2,896 visits.
(B) The sanitary staff, consisting of eight district inspectors	14,465 ,,
Total visits	17,361 ,,

Inspector Watson confined his visits to the streets lying nearest to the harbour, the area searched by him being : The Praya from Kennedy Town to Causeway Bay, by Queen's Road West, Pokfulum Road, Bonham Road, down Eastern Street to Queen's Road, along Queen's Road to Wanchai Road, and hence to Valley and Causeway Bay. Taking on an average every fourth house, this area was gone over by him on several occasions, so this area may be considered to have been very thoroughly searched.

* Table II. : not printed.

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The sanitary staff visits were not restricted to any special area, but were spread over the whole city of Victoria. If the number of dwelling-houses is taken as about 8,700, then the number of visits paid by the sanitary staff is equal to, roughly, two per house.

The percentage of houses in which larvæ were found to the number of houses visited varied markedly with the season of the year, and the positive results obtained by Inspector Watson are much higher than those recorded by the sanitary staff.

Table I. records the monthly number of visits and the number in which larvæ were found; this is also shown graphically in Table II.*; from these tables it will be seen that Inspector Watson found larvæ in from 80 per cent. of the houses visited downwards to almost nil in the cold weather in February.

On the other hand, the highest percentage of larvæ found to visits paid by the sanitary staff was 10 per cent. Judging from the visits which I have myself paid, I do not think that Inspector Watson's figures overestimate the prevalence of mosquito larvæ in houses in the city of Victoria; his results would, in fact, have been considerably higher but for the fact that he became so well known to the Chinese that his appearance in a street was a signal for a general emptying of pots, water-barrels, &c., with the result that after the first few houses had been done only empty dishes were found.

It is probably true that in the summer almost every Chinese house has mosquito larvæ somewhere, either in the kitchen, backyard, flower-pots, &c.; there is a marked seasonable variation, very few larvæ being obtained in January and February.

The number of samples of larvæ sent in for examination was 1,238. This number would have been very much larger but for the fact that it was not possible to carry separate tubes for every house, and so the findings of several houses were pooled into one tube.

From these samples 6,511 adult mosquitoes were bred out and pinned, and kept. A large number more were examined, but, being all the same, were not preserved.

The complete examination of such a large number of mosquitoes is not finished yet, but it is fairly safe to say that, with one exception, no *Stegomyia fasciata* were found. The predominating mosquito is *Stegomyia scutellaris*, which can be found nearly everywhere; *Culex fatigans* and various other culicines form a small percentage, but the exact proportions are in the course of being worked out.

As far as the investigation has gone, it is evident that *Stegomyia scutellaris* is the common mosquito in the houses and backyards of the city of Victoria, and that for all practical purposes *Stegomyia fasciata* does not exist. Of course, the work is being continued, but after a year's search I cannot consider it probable that *Stegomyia fasciata* exists to any appreciable extent in Hong Kong. The only specimen found was taken from Jervois Street, and though this area was repeatedly searched no further specimens have been obtained.

If further experience confirms the results of the year's work already done, a very curious position will be displayed. *Stegomyia fasciata* is recorded by Theobald as common in Japan, the Philippines, and Singapore. From all of these places ships are constantly coming to Hong Kong, and as *Stegomyia fasciata* is said to be a good traveller on ships, it would appear that it must frequently have been brought here.

Dr. K. Werkman, of Leyden, who has been working in this institute on mosquitoes, had no difficulty in collecting and bringing back specimens of *Stegomyia fasciata* from the ports of Tandjoing Priok, Semarang, and Soerabaya, in Java, during a trip down there in the Dutch Steamship Line, which is constantly running steamers backwards and forwards from Hong Kong to Java.

Hong Kong has been a large port for many years now, and very many ships have entered it from ports infected with *Stegomyia fasciata*. There has, therefore, been ample opportunity for *Stegomyia fasciata* to arrive and establish themselves here, but the results of the search as far as it has gone show that they have failed to do so.

Dr. Chan Tsun Kun, the Bacteriologist to the Government of Canton, late Bacteriological Assistant in this institute, informs me that he has been carrying

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* Table II : not printed.

out a similar search for *Stegomyia fasciata* in Canton, and that he has examined over five thousand specimens there with a negative result, no *Stegomyia fasciata* having been found. This is of great interest as confirming the results so far obtained in Hong Kong.

It seems to me very curious that *Stegomyia fasciata* is not prevalent in Hong Kong and Canton, and I am unable to offer any explanation.

THE COLLECTION OF ANOPHELINES AND OF CULICINES OTHER THAN STEGOMYIA.

This work is making steady progress, but is not sufficiently advanced for any definite report.

It is, however, already evident that there are considerably more species of anophelines in Hong Kong than the three already recorded, and it is also extremely doubtful if *Pyretophorous minimus* occupies the position assigned to it in Dr. Thomson's report.

The work will be continued till next spring, when I go on leave, and I hope to take a representative collection home to be finally worked out there during my leave.

The great financial importance of a really exact determination of the anophelines of a district has been so well demonstrated lately (*e.g.*, Bentley's Report on Malaria in Bombay, 1911; Christophers' "Malaria in the Andamans"), that it is hoped to carry on this work till an equally exact knowledge of the anophelines of Hong Kong is obtained.

TABLE I.

STEGOMYIA SURVEY—CITY OF VICTORIA—JULY 1ST, 1912—JUNE 30TH, 1913.

Collectors—
(A) Inspector Watson—in his spare time.
(B) The sanitary staff, consisting of eight District Inspectors.

Month.	Collector.	Number of Visits.	Number of Houses in which Larvæ were found.	Per cent.	Number of Samples sent for Examination.
1912.					
July	Inspector Watson ...	1,000	800	80·0	All
	Sanitary Staff ...	—	—	—	—
August ...	Inspector Watson ...	768	286	37·2	All
	Sanitary Staff ...	1,633	147	9·0	All
September ...	Inspector Watson ...	—	—	—	—
	Sanitary Staff ...	1,267	120	9·4	All
October ...	Inspector Watson ...	95	6	6·0	All
	Sanitary Staff ...	871	61	7·0	All
November ...	Inspector Watson ...	80	6	5·0	All
	Sanitary Staff ...	1,323	63	5·0	All
December ...	Inspector Watson ...	40	4	10·0	All
	Sanitary Staff ...	986	43	4·3	All
1913.					
January ...	Inspector Watson ...	390	16	4·0	All
	Sanitary Staff ...	1,139	24	2·0	All
February ...	Inspector Watson ...	—	—	—	—
	Sanitary Staff ...	313	14	1·3	All
March ...	Inspector Watson ...	189	8	4·0	All
	Sanitary Staff ...	1,060	14	1·3	7
April	Inspector Watson ...	198	36	18·0	All
	Sanitary Staff ...	1,040	14	1·3	2
May	Inspector Watson ...	82	23	28·0	All
	Sanitary Staff ..	1,769	70	4·0	All
June	Inspector Watson ...	54	27	50·0	All
	Sanitary Staff ...	1,458	152	10·4	148
July	Sanitary Staff ...	1,606	135	8·0	All

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No. 8

JAMAICA.

The GOVERNOR to the SECRETARY OF STATE.

(Received 5 May, 1913.)

(Extract.)

Sir, King's House, Jamaica, 15 April, 1913.

In continuation of Sir Sydney Olivier's despatch, dated the 31st October, 1912,* I have the honour to transmit, for the information of the Committee of the Tropical Diseases Research Fund, the fourth half-yearly report by the Government Bacteriologist of this Colony on the work carried out by him during the period from the 1st October, 1912, to the 31st March, 1913.

I have, &c.,
W. H. MANNING,
Governor.

Enclosure in No. 8.

Fourth Six-Monthly Report on the Work of the Government Bacteriologist, October, 1912—March, 1913..

The Pathological Laboratory, Kingston, Jamaica,
March 31st, 1913.

Sir,

I have the honour to forward, for transmission to the Right Honourable the Secretary of State for the Colonies, this my report upon the work carried out by me during the period October 1st, 1912, to March 31st, 1913.

As will be seen on perusal of the tabular statement appended hereto a very large number of specimens has been dealt with, and the examinations carried out have been of a very varied nature. This is the only laboratory in Jamaica where pathological and bacteriological investigations can be performed, and not only are all the usual clinical pathological examinations, such as are necessarily required in connection with a large general hospital, undertaken here, but also medical men all over the Island—those in private practice, those in the medical service as District Medical Officers, and those engaged in public health work—are availing themselves to an ever-increasing extent of the help which is offered to them in diagnosis and treatment by the opportunities thus afforded of sending up material for examination at the laboratory.

In addition to this, during the six months under review some important research work has been taken in hand.

In my last report the statement showed that just over 3,000 investigations had been carried out between April 1st and September 30th, 1912; this number has been surpassed during the succeeding six months, giving a total for the year of 6,197.

It is clearly impossible in this report to describe in detail the various investigations which go to make up this number. In the September report the question of enteric fever was the chief one dealt with, so this, though important and apparently as prevalent as ever, will be merely mentioned briefly. The most important matter of which it is proposed to treat *in extenso* this time is that of vomiting sickness.

It will be as well to dispose first of the subjects calling for brief mention :—

I. Enteric Fever.

The number of specimens of blood sent to the laboratory for Widal's reaction is slightly in excess of that for the previous six months. The same methods of examination have been carried out as were reported in detail in October last. Of a total of 568 sent up, 203 gave a positive agglutination of *Bacillus typhosus*, or 35·73 per cent.; with *B. paratyphosus* A 102, or 17·95 per cent.; 27 gave reactions pointing to a double infection, while the remaining 236, or 41·54 per cent., were negative.

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* No. 4 in Appendix VI. in [Cd. 6669].

Thus, of a total of 305 which reacted positively to either *B. typhosus* or *B. paratyphosus* singly 102, or 33·4 per cent., did so with the latter organism. This bears out almost exactly what was found to be the case during the preceding period of six months. Inclusive of those giving the double reaction, 58·45 per cent. of the specimens sent were positive to one or other, or both, of the organisms in question. The three dilutions of 1 in 30, 1 in 50, and 1 in 100 were employed as before with time limits of 15, 30, and 60 minutes respectively. Though the total remains high, there has been a general decrease from 118 in October to 48 in the present month.

II. Ankylostomiasis.

The question of ankylostomiasis in this Island is a very important one, leading to a considerable amount of incapacitation among the coolies, and to a less extent among the natives also. With the introduction of a place of detention for treating all immigrating coolies, whence they can be sent up to various parts of the Island after being cleared of these parasites, the amount of infection must indubitably be lessened, though the soil around the habitations of the earlier arrivals, who have not been so treated, is highly infected.

This condition is much more common than has been supposed. The Honourable the Superintending Medical Officer has from time to time directed that a certain number of specimens from different estates were to be sent up weekly for examination for the ova of worms, and in some districts where there was believed to be little or no infection by these parasites nearly 100 per cent. of the specimens forwarded revealed their presence, and in many instances in large numbers.

Briefly, it may be stated that of 644 specimens sent up no less than 511, or 79·3 per cent., showed the presence of ova of the hookworm, and in the majority of them both *Ascaris lumbricoides* and *Trichocephalus dispar* were also found.

III. Dysentery.

Not many specimens have been forwarded to the laboratory for examination for the amœba or bacillus of dysentery, although this disease has been rife in parts of the Island. Both varieties are present here. Out of 53 specimens sent up 21 proved to be the bacillary form and 29 the amœbic; in three neither could be found. Of the former, Flexner's organism is mostly present, though on three occasions I have isolated the Shiga bacillus.

The nature of the other matters dealt with will be gathered from a perusal of the tabular statement appended. Though important, they form largely the routine work of a clinical laboratory, and do not call for detailed discussion.

Passing on to the main subject of this report, namely,

IV. Vomiting Sickness.

Reports which have been presented by me in September and December, 1912, and in February, 1913, showed that certain investigations had been taken in hand to elucidate the nature of this dread disease prior to the date of the arrival of Dr. Harald Seidelin (on January 9th). This investigator was sent out from the Liverpool School of Tropical Medicine to study the disease, and, as it was not possible for one man to carry out all the work of morbid anatomy and bacteriology in connection with the many cases which have occurred, and also because Dr. Seidelin had frequently to be absent from the laboratory in order to see the patients in the inland districts, he did me the honour of asking me to carry out the bacteriological part of the investigations. This, of course, I was only too happy to do, the understanding being that in the cases which he himself had seen I informed him of the results of the cultivations and mentioned beforehand what steps I proposed to take, in order that they might have his approval, and that in these cases my investigations might be undertaken definitely under his directions. Such cases are marked with an asterisk in the brief reports of individual cases.

I find myself considerably handicapped in attempting to write of the vomiting sickness in detail for the reason that Dr. Seidelin was working in this laboratory, and I do not desire in any way to forestall his report, which will be made in due

course to the Liverpool School. In order to avoid any suspicion of this, I am of opinion that it will be better for me to omit altogether the morbid anatomy aspect of the question and confine myself solely to the bacteriological.

From this point of view, and as arising out of the findings given in my previous brief communications, the main question may be condensed to this: what connection is there, if any, between vomiting sickness and hyperacute cerebro-spinal meningitis?

To present the matter before you in a connected state it will be necessary to trace the investigations from the beginning. I must, therefore, briefly relate the steps taken prior to the time with which the present report is supposed to deal. As a matter of fact, almost the whole of the work of this investigation has been carried out since my previous report was presented, so a very few words will suffice to sum up the state of this question as it stood at the end of September, 1912.

On September 4th a sudden outbreak of a peculiarly fatal disease occurred in Kingston, and in one family four children, varying in ages from 14½ to 3½ years, died within twelve hours; while a fifth, aged 11 years, was also attacked, but recovered.

A report on these cases was made on September 16th, and the following summary may be cited:—

(1) In four cases presenting the typical symptoms of "vomiting sickness," Weichselbaum's diplococcus was isolated.

(2) The symptoms corresponded clinically in many, if not most, respects with those occurring in Foudroyante types of cerebro-spinal meningitis.

(3) The organism was obtained from the cerebro-spinal fluid of three of the patients, from whom this fluid was taken by lumbar puncture during life, and also from the cerebral ventricular fluid after death.

(4) The organism was obtained and cultivated from the upper reaches of the naso-pharynx of one of the contacts of these cases (a brother aged six years), though himself apparently in perfect health.

(5) The intra-cranial post-mortem signs were such as are consistent with death from cerebro-spinal meningitis at an early stage with fulminating cases of the disease. The duration of illness in the four fatal cases was respectively 7, 9, 10, and 11 hours.

This focus did not spread, and the child who was proved to be harbouring the organism did not develop the disease. The history of these patients was typical of many of the acute cases of what has been called "vomiting sickness"; in fact, the medical man who sent the patients to hospital stated that had they been attacked during the winter months, he would have described them as typical "vomiting sickness" cases.

This is the position taken up by many of those practising in the country districts, namely, that if they meet with cases in the colder months, they call them vomiting sickness, but at other times of the year, the deaths are certified as due to worms (which are present in most of the native children), gastro-enteritis, food-poisoning, &c.

In my opinion this idea is responsible for many sporadic cases being overlooked, and it is possible that such carry on the infection through the summer, and form the starting-points of the localised epidemics in the colder season.

From the cultures of these cases I prepared a vaccine, not with a view of curative treatment of subsequent cases, for as a rule the course is too acute—death often occurring in three to four hours after the onset of the first observed symptom—but as a prophylactic in districts where the outbreaks mostly take place.

Having been struck by the peculiar hyperacuteness of these cases and by the remarkable similarity of the symptoms to those reported from various parts of the Island as occurring in the devastating epidemics which arise every cold weather, preparations were made for thoroughly testing the hypothesis that some at least of these cases might be specially acute cerebro-spinal meningitis.

(*a*) Forms of report giving the details of various symptoms of those patients who might be seen during life were drawn up by the Honourable the Superintending Medical Officer.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

(*b*) Special forms for reports of post-mortem findings (different from the usual forms) were drawn up. These two forms were printed and sent to the various District Medical Officers, requesting them to fill them in to the best of their ability, and to forward certain specimens to me at the laboratory.

(*c*) Since the organism does not grow well on ordinary nutrient agar. sloped tubes of nutrose ascitic agar were prepared and placed in boxes containing also sterilised swabs, slides, and ampoules of vaccine. These boxes were likewise distributed to the District Medical Officers in the various parts of the Island with directions as to the use of the materials contained. The tubes of sloped nasgar were for inoculation with cerebro-spinal fluid obtained by lumbar puncture, and for inoculation with material obtained by means of the sterile swabs from the upper reaches of the naso-pharynx of contacts. The slides were for smears of the spinal fluid and of blood (as some of the cases might be malarial or associated with malarial parasites). The vaccine for use with contacts for prophylactic purposes.

(*d*) Anti-meningococcal serum was ordered.

Since the organism, presuming that a variety of the meningococcus might be the cause, is far from being a resistant one, it was considered that if the spinal fluid itself was sent the organism might die before the specimen reached the laboratory, so that cultural tests could not then be carried out. In some instances there is an interval of over twenty-four hours between the time of despatch of a specimen and its arrival at the laboratory. Secondly, that if the organisms were present in small numbers only they might be overlooked in a smear. Thirdly, that if the inoculation of the selected medium were made on the spot, colonies would in many cases develop by the time the specimen reached the laboratory, and examination of these and subcultivation could be performed the same day, and in this way a considerable saving of time would be effected.

On the whole I may say that this system has worked very well. The majority of the District Medical Officers have been most hearty in their co-operation, and to their full notes and ready response to many questions with which I have had to worry them is due a considerable part of the credit for the success attained.

In several instances the tubes on arrival at the laboratory showed pure cultures, and in others there was sufficient growth to enable plating to be carried out at once for purposes of isolation. The procedure subsequent to the box and its contents reaching the laboratory has been as follows:—

(1) Smears were examined for enumeration of leucocytes and the relative proportions in which they were present, and for observations of any diplococci, intracellular or otherwise. A second smear was stained by Gram's method or Claudius's modification of it, and counterstained. Sometimes, where nothing definite could be made out from the smears sent of the cerebro-spinal fluid, another smear of the liquid in the culture tube would give indications of the varieties of organisms present.

(2) Any likely-looking colonies on the culture media were subcultured and examined.

(3) The growth in the culture tube was plated for purposes of isolation.

(4) The colonies so isolated were then examined and subcultures made on nasgar, and ordinary agar, and incubated at 37° C. and at 25° C.

(5) From the growth so obtained (only the former showed any in many instances) the effect on various sugar media was noted. Dextrose, maltose, galactose, saccharose, lactose, and mannite being usually employed.

It will thus been seen that a large number of tests and examinations has had to be carried out with every specimen sent up. The results of all these have been entered in a separate book of records of these cases, together with an abstract of the history and post-mortem reports sent up by the medical men, the originals of these being filed for future reference at any time.

Returning to the description of the various cases which have come to my notice, it would be tedious and would unduly prolong this short paper to give details of the history of each one. Appended to this report is a list of the cases which I have seen

personally or of which notes have been sent to me, giving brief extracts of the history when obtainable, the results of the bacterial investigations, and remarks, where necessary. The usual train of symptoms is as follows:—

The patient, usually a child, goes to bed apparently in its ordinary health, or there may be a history of slight indisposition, a cold in the head, or some loss of appetite, or a tendency to be "droopy" and to lie down during the day preceding the actual onset. During the night the child wakes up and vomits—perhaps only once, perhaps three or four times—and complains of "feeling ill." After an hour or so he drops off to sleep again, and some three or four hours later, more or less, again wakes up, complains of pain in the stomach (pain is used as a term for mere discomfort frequently among the native population), and almost immediately begins again to vomit, usually frothy mucus, occasionally bile-stained, and later only watery fluid, with, in most instances, little or no effort, unless the stomach is quite empty, when troublesome retching ensues; if, however, food is taken, either solid or liquid, there is apparently effortless vomiting.

In a very short time, often a matter of a few minutes, convulsions come on and there is "stiffness of limbs" and a "drawing back of the head" (as the parents describe it); coma rapidly succeeds and terminates in death.

In some there is no stiffness or retraction, but a general limp condition. The total duration is short, the average being about twelve hours or a little more or less, the most rapid in my experience was thirty-five minutes. Frequently, therefore, the patient is not seen during life, and the history is both incomplete and unreliable, as it is obtained by questioning the parents, who, in a general perturbation of sudden and fatal illness, have not noticed particular symptoms, and, unless volunteered by them, their statements, either in affirmation or denial, of a definite symptom is of little value, a reply to a leading question often varying with the form of that question.

When seen during life the child is usually in the convulsive or comatose stage, the temperature is rarely high, usually 101°-102° F., but it may be normal. The pulse rate is between 90 and 100, often fairly strong; respiration 26-30, regular till towards the end, when the Cheyne-Stokes type may appear. Kernig's sign is present in some of the cases, and may be distinctly more marked in one leg than the other; rigidity of the neck muscles is more common than retraction of the head, and this rigidity is often overlooked because the flexion is not attempted in the strictly middle line. Rigidity may be fairly marked, but when the flexion is combined with lateral movement (as is the case when the test is applied with the child lying on its side), the stiffness may be masked, since lateral movement may be comparatively free in spite of distinct rigidity of the neck muscles. The pupils are usually equal, moderately dilated, and, if the coma is not deep, react normally. In a few there is photophobia, and in those retaining consciousness general irritability and complaints of headache—not always by any means severe—usually frontal, sometimes general. Delirium is, so far as I have seen, quite uncommon; shortly before passing into the comatose state, the child may remark that it "feels very bad," but does not call attention to any particular symptom or locate the pain, if complained of, to any particular spot.

In cases which do not end fatally, the state of coma is rarely present; there is vomiting, headache, convulsions with temporary loss of consciousness only, and recovery is almost as rapid as the onset. Within twenty-four hours a child who has been seriously ill may be sitting up in bed, and in another twenty-four to forty-eight hours is up and about, showing practically no symptoms except a little pallor, general debility which rapidly clears up, and some residual headache of no great severity, while others in the family, who did not seem to be any worse at the time, have passed into a state of coma and died in a few hours.

More exact details of a few cases may be given to point out the average trend of instances of this disease, and after that a general summary will be given, demonstrating certain matters, such as the age, sex incidence, the average duration, and so forth.

In the following descriptions where the words "usual history" are employed, the course of events has been that sketched above.

The next case after the Franklin Town outbreak which came under my own personal notice (the tenth of the series of which I have notes) occurred also in

Kingston, on October 1st, 1912. This was more prolonged than the general run of cases.

(10) Male child, aged 6 years, was apparently quite well on September 25th. During the night he awoke and complained of intense headache, calling out "My head, my head." He went to sleep again, but in the early hours of the morning of the 26th awoke and again called out with headache, was seized with fits, and lost consciousness; there was slight vomiting, which was more severe next day. When admitted to hospital on October 1st, there was definite retraction of the neck, Kernig's sign marked, pupils dilated and equal. The child was quite conscious. The cerebro-spinal fluid was turbid and showed well-marked intracellular cocci, Gram-negative and diploid, with 84 per cent. of the leucocytes of the polymorphonuclear variety.

A good growth of meningococci was obtained, from which a vaccine was made.

During the succeeding three weeks, the patient's condition became gradually worse; there was general flexion and irritability, retraction of neck, wasting, &c., but very few twitchings and still some vomiting. There was no serum at hand, so an injection of 100,000,000 cocci was administered on October 24th. Note made on October 26th: "Patient brighter and improving, temperature lower." On November 7th: "Improvement steadily maintained; retraction gone, Kernig's sign absent, is getting up and taking plenty of nourishment." Two days later he went home, and reports state that he is in good health, but exhibits violent outbursts of temper on trivial grounds, quite contrary to his former disposition.

This was in onset like an ordinary hyperacute case of cerebro-spinal meningitis, but later took on the characters of the subacute and recovered.

(11) P. McM., aged 4 years. History typical, namely, apparently well at 11 p.m. on October 12th; early on 13th was dull and restless (usually very bright and cheery), doubtful headache—child held its head but did not make any definite complaint of pain there. About 7 a.m. child had a convulsion, with her head thrown back and with general twitching and stiffness. She rapidly lapsed into coma and died without recovering consciousness.

At the autopsy the vessels of the surface of the brain were congested; there was a pearly haze over the hemispheres with flakes of lymph in two or three spots. Ventricles contained excess of fluid, and a smear of the cerebro-spinal fluid showed intracellular, Gram-negative diplococci. Culture obtained on nasgar and proved by subsequent tests to be the meningococcus.

(12), (13), (14) Three children, sisters. Vera Pine, aged 8 years, Amy, aged 2 years, and Esther, aged 9 months, were brought to hospital on October 23rd, 1912. All three gave a history of headache and vomiting, and Amy showed some staggering (she was old enough to walk straight when well), stiffness of the neck muscles was present in all, Kernig's sign present in the two older, but doubtful in the baby. Swabs taken from high up in the naso-pharynx (lumbar puncture was not permitted), gave meningococcus on cultivation mixed with catarrhalis and some Gram-positive bacilli (? Hofmann), but separated by plating. They were all three seriously ill for the next week or so, especially the two younger, but after that made steady progress towards recovery.

It may be added that the mother of these children complained of pain along the neck and shoulder, and of headache, but the organism was not obtained in her case.

(15) J. L. B., male, aged 4 years. October 19th. History given was that which has been described at length above. The duration of illness was only two hours. At the post-mortem examination the "meninges were markedly congested, fluid in excess in the cerebral ventricles and at the base of the brain. The fluid was turbid uniformly." (Quoted from notes sent.) No specimens forwarded, so the cause was not proved.

(16) C. M., male, aged 13 years. Reported December 1st, 1912, from Montego Bay. The only indication of anything which might be regarded as a premonitory symptom was a "fresh cold" for a week preceding the sudden onset of vomiting at 4 p.m. The patient became unconscious at 6 p.m., convulsions started at 7 p.m., and recurred at intervals till death at 3 a.m. the following day. The total duration

was, therefore, eleven hours. The meningococcus was isolated from the cultures taken.

(17) C. M. A., female, aged 4 years. December 7th. Usual history except that the patient was said to have retained consciousness till death. The medical attendant states that he did not see the patient during life and that the "father's statements as regards the symptoms are unreliable." Duration of illness was 15 hours. Culture of spinal fluid yielded the meningococcus.

(18) H. W., female, aged 6 years. December 7th. Usual history. First symptom—vomiting—started early in the morning and death occurrred at 10 a.m. The culture sent from this case was contaminated, probably owing to the long interval (56 hours) between death and the autopsy, and I was unable to isolate the diplococcus. This case, therefore, was associated with a Gram-negative diplococcus in the spinal fluid (it had been seen in the original smears of this fluid sent), the nature of which was not definitely proved.

(19) A. J., male, aged 2 years. December 19th. Usual history of vomiting succeeded by coma, but there was no mention of convulsions. Duration of illness, six hours. Meninges dull, vessels congested; fluid in ventricles and spinal canal in excess and turbid. The fluid sent showed Gram-negative diplococci, but they did not grow on the culture medium. The fact of their not growing is not an insuperable argument against the organism being the meningococcus. It is not rare for a strain of this organism to die rapidly in spite of every care taken to cultivate it.

(20) R. T., female, aged 6 years. Porus District, December 22nd, 1912. This case forms the main subject of my second note on December 25th. Having been sent down to investigate a small outbreak at Porus, I was able to see the patient myself during life, to take specimens of the blood and spinal fluid, and to perform the autopsy almost immediately after death took place. The patient was a well-nourished child and was said to have been quite well until 6 p.m. December 21st, when an attack of vomiting came on. There was little or no complaint of headache. After sleeping for several hours, she commenced to have attacks of convulsions at intervals, from 4 a.m., December 22nd, during which she "went quite stiff." When I saw the patient at 12 noon she was comatose. There was a general limp condition of the muscles, but on flexing the head in the middle line, the neck muscles felt hard and stiff. Kernig's sign was marked in both legs, but more in the left. There was a small group of herpetiform spots on the lips at the right side of the mouth, but no discernible rash on the body.

I took a blood smear and also spinal fluid smears and some of the latter for culture. There was no recovery of consciousness, and death took place at 12.30 p.m.; the total duration from the first symptom being $18\frac{1}{2}$ hours.

The smears of the spinal fluid taken showed many Gram-negative diplococci, several intracellular, but more lying free. The blood smear also showed well-marked diplococci; this is the only case in which I have seen them in a blood smear taken during life, though it is only right to say that I have had very few opportunities of examining blood smears taken shortly before death.

The culture tubes showed several small colonies of Gram-negative diplococci, which subsequent tests proved to be meningococci, and in this instance, therefore, not only was there definite cerebro-spinal meningitis, but a condition of meningococcæmia was proved to be present.

(21) D. D., male, aged 11 years. December 20th, 1912. The history of this case was typical, except that the symptoms were a little more drawn out. He complained of frontal headache and chilliness at 11 a.m., December 18th, and vomited in all sixteen times during that and the succeeding day. Was walking about in the evening of the 19th, and complained about 11 p.m. that the lamplight hurt his eyes. He was restless all that night, and had frequent convulsive movements of the limbs with retraction of the head and neck, and general signs of cerebral irritation till 4 a.m., December 20th, when coma supervened, and he died at 11 a.m. The duration, therefore, was forty-eight hours.

Post-mortem report stated that there were some round worms in the intestines, and some congestion of the mucous membrane of the stomach, but beyond this the only abnormality noticed was marked congestion of the meninges and a general

dulling and loss of glistening appearance of them, with excess of fluid in the ventricles.

No cultures or specimens were sent from this case, so the proof of the cause was not forthcoming. The case is described for two reasons: firstly, because several similar cases followed it in which the organism was detected, and secondly, because it is a good example of the partial recovery, or comparatively calm interval between a violent onset and an equally violent return of more serious symptoms which usually terminate fatally.

(22) R. E., male, aged 7 years. December 24th, same district. Usual history; duration 24-30 hours. Spinal fluid gave typical cultures and the meningococcus was proved.

The last mentioned were the first of a small epidemic in this district. Details of the individual cases need not be given, as they would be largely a repetition of what has been already stated, nevertheless, there are some points of interest about them, which may be briefly summed up as follows:—

Nineteen cases occurred during the last week of the year 1912, of which notes were sent to me. In nine of these no lumbar puncture was performed, and, therefore, however typical the symptoms, they cannot be said to be proved cases of meningitis. In seven of the nine, however, nearly all the classic symptoms—headache, vomiting, irritability, rigidity, Kernig's sign—were present, so that there is a fairly strong probability that these were instances of the disease; two of them recovered within three days, and the rest within a week.

In six of the remaining twelve there was no symptom recorded except vomiting; these also rapidly cleared up with a stomachic mixture, and I think that they were probably merely gastric disturbances of a mild type.

Lastly, in six the meningococcus was isolated from the spinal fluid and proved; and three of them terminated fatally—one, aged 7 years, was ill for thirty hours; a second, aged 3½ years, died after ten hours' illness; the duration in the case of the third, an adult, could not be ascertained.

Twenty-two subjects, nine of them contacts and thirteen showing what were thought to be early symptoms of the condition—vomiting (with no ascertainable cause), headache and malaise—were given an injection of the vaccine which had been prepared by me from a former case. Of the thirteen, three were proved by culture from the spinal fluid to be definite cases of cerebro-spinal meningitis; of the remaining ten there is no evidence to show whether they were case of meningitis, worms, gastro-intestinal upset, or, for the matter of that, any other disease associated with vomiting; but it may be mentioned that none of the vaccinated contacts have so far been attacked, and none of the suspected or proved cases who had been vaccinated have died.

In the smear of the spinal fluid from a boy of 7 years of age who died in ten hours, and in whose case the meningococcus was isolated, I found also several spirochæte-like bodies, or they may have been long curved involution forms of some bacillus, which, however, would not grow on the ordinary media. Whether these have any causal connection with the disease I cannot say, but I may mention in passing that in three cases in which they have been seen the course has been exceptionally rapid.

Of eleven cases subsequently reported from this district with symptoms similar to those already detailed, spinal fluid cultures were sent up from seven. In three instances the meningococcus was isolated, in three no growth occurred; in the remaining tube there was a slight growth which had developed during the transit of the tube to the laboratory, but on arrival there (after the laboratory had been closed for the day) the box containing it was, in excess of zeal on the part of the recipient, placed on ice, and the organism had been killed, for sub-cultivation failed altogether.

I did not expect any beneficial results from vaccine treatment in the acute cases of the disease, as has been already stated. The vaccine was intended for prophylactic use mainly, and secondarily for chronic cases should such be met with. For the acute and hyperacute cases the anti-meningococcic serum was ordered, but there are points militating against its employment even in many of these. Firstly, there is the difficulty of keeping the serum in warm climates in districts where no

ice is obtainable; secondly, though it has been stored in various parts of the Island where ice can be procured, nevertheless, many of the cases are so rapidly fatal that death occurs before the serum arrives, although it may have been telegraphed for on appearance of the earliest symptoms and have been despatched by special messenger without delay; thirdly, the serum must be injected intraspinally, and repeated on three successive days at least, and if the case terminates fatally, the parents are almost certain to ascribe the death to the medical man's action in injecting fluid into the spinal canal.

Apart from the cases in which the vaccine was used prophylactically, I do not think that the conclusion is justified that the happy results following its employment in some of the cases referred to above can be attributed to its use. The condition was too severe for the small doses employed to have much effect, if any; also the amelioration was too rapid, and has been too well maintained to justify any inference that the improvement leading to recovery was the direct result of the small injections made. I feel that, though "post hoc," there are no grounds for regarding the recovery as "propter hoc," at all events, until further reports of the efficacy of the vaccine in similar cases have been received.

The remainder of the cases need not be mentioned in detail individually, as the descriptions would be mainly but vain repetitions of what has been already stated. The characters of the whole series may be summarised under the following heads:—

(1) Age incidence of all cases reported as vomiting sickness.
(2) Sex influence.
(3) Average duration of disease in cases ending fatally.
(4) Proportion of cases in whom a Gram-Claudius-negative diplococcus was obtained from the cerebro-spinal fluid and cultivated.

(1) With regard to the age incidence the following table shows that of 183 cases 104, or 56·8 per cent., occurred under the age of five years, while of the 52 cases in which the diplococcus was isolated from the cerebro-spinal fluid 30, or 53·8 per cent., were from children below the age of five years.

(2) Sex influence. This point is not of much importance in a condition such as vomiting sickness, which is undoubtedly not a single clinical entity, but taking all cases reported to me this year the difference is not marked; thus, of the total 183, 99, or 54·1 per cent., were males, while 84, or 45·9 per cent., were females. Under five years of age, though there are differences shown for individual years, the total works out at 52 of each.

Sex, therefore, from the data at hand, apparently has little or no influence.

(3) Average duration of illness in fatal cases. The average duration of all the hyperacute cases, that is omitting those who lived longer than three days (only four did so), comes at 14 hours in females, and 14½ in males; the shortest in either sex was half an hour between the first observed symptom and death. Two such occurred amongst female children and one amongst the males.

(4) Proportion of cases from whom a Gram- or Claudius-negative diplococcus was obtained from the cerebro-spinal fluid and cultivated. Out of the total 183 this was isolated from 52, or 28·4 per cent.; it must be stated that in twelve other instances primary smears or primary cultures showed an organism morphologically similar, but subculture failed and isolation could not be carried out. As there is in these no confirmatory evidence they can only be spoken of as probably or possibly belonging to the same category.

In conclusion, it will be, I think, advantageous to summarise my views on this important question. Dr. Seidelin has not communicated his opinions to me, so I cannot say to what degree they are in harmony with my own; at the same time it is well to place my ideas on record as it will be interesting to see when his report is published to what extent his findings corroborate or differ from mine.

The question relative to hyperacute cases of cerebro-spinal meningitis, resembling in many of the details the symptom-complex of vomiting sickness, may be summarised thus:—

(1) In several cases of illness with sudden onset in apparently healthy subjects, terminating fatally in a high percentage of those attacked, I have isolated a Gram-Cladius-negative diplococcus from the spinal fluid.

(2) This organism gives the morphological and cultural characters of the meningococcus, except that in galactose it does not always give a definite reaction, the medium in some instances not being affected. The maltose and dextrose, however, are always typically acted upon.

(3) These cases exhibit in many instances a symptom-complex which has for years been spoken of in Jamaica as the vomiting sickness.

(4) The disease breaks out in localised epidemic form in various parts of the Island every cold weather, that is, from about the middle of December to the middle or end of March.

(5) The disease occurs at other times as sporadic cases, but apparently does not spread extensively.

(6) It is a curious thing that practically all the cases are of the hyperacute variety, either recovering in a few days, or dying in a few hours. One rarely sees the subacute cases during the epidemic times, and never, so far as I am aware, the chronic ones, unless some of those one meets who are chronically deaf, or have seriously defective vision, or who suffer from fits, are instances of cerebro-spinal meningitis with permanent sequelæ. Of this there is no proof.

(7) In three instances a spirochæte-like body has been seen in the smears made directly from the fluid obtained by lumbar puncture. What part, if any, this takes in producing the symptoms I have not been able to determine.

(8) The disease is very rare amongst the white population; I have only known of three instances so far during the past year. Possibly, this is due in part to better hygienic conditions, less crowding, and so forth, but not entirely, because—

(9) I have not met with the condition once during that period among the East Indian population (though a diplococcus was seen in the primary smears, but did not grow on subcultivation, in two cases, so these cannot be regarded as more than probable or possible instances), where overcrowding and bad hygiene are nearly, if not quite, as marked as amongst the West Indian natives. For this also I am unable to offer any explanation; it must not be forgotten, however, that the East Indian certainly has better food than the West.

(10) The facts related enable one to say that in a certain proportion of cases exhibiting the symptom-complex of vomiting sickness wholly or in part, the meningococcus is present, but it does not prove that this is the only cause at work. One is not justified in stating more than this: that, after exclusion of such conditions as worms, gastro-enteritis, marasmus, food-poisoning, &c., there is a large residue of cases, some of which are due to the meningococcus or a very closely allied organism, often alone, but at times probably in combination with some other organism, while there still remain a large percentage of cases yet unaccounted for.

Briefly, then, to the question propounded at the beginning of this section, namely: "What connection is there, if any, between vomiting sickness and hyperacute cerebro-spinal meningitis?" the reply may, in my opinion, be stated thus:—

(1) Clinically, some cases reported as vomiting sickness are associated with the meningococcus or a closely allied organism.

(2) Thorough examination will usually enable distinct clinical differences to be established. Many of the severe cases of vomiting sickness show no retraction of the head, no Kernig's sign, no general tenderness, no fever, no eruption, and so on.

(3) The post-mortem findings reveal in many cases little or nothing abnormal in the brain and spinal cord or their meninges.

So that, though cases of meningitis occur amongst those reported as vomiting sickness, the two diseases are not, I believe, identical. After the former have been excluded, a large proportion still remains unaccounted for, so far as actual knowledge of the cause goes at present.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Without encroaching on what Dr. Seidelin may have to report, for, as already stated, he has naturally not revealed his opinions to me, I may finally state, merely as a surmise which I put forward tentatively, and which future investigations, I am well aware, may not fully endorse, the following:—

(1) That the condition (apart from true meningitis cases) is one of acute toxæmia, possibly a septicæmia, the poison, whatever its nature, bacterial or otherwise, tending to produce hæmorrhages in various organs, with fatty degeneration in many cases, sometimes associated with Claudius-negative diplococci in the spinal fluid, giving somewhat variable sugar reactions, but more often not associated with the presence of such an organism.

(2) That, if it is due to an organism, it is one which will not grow on the ordinary culture media employed, agar, nasgar, hæmoglobin or blood-agar, under aërobic conditions, for in many instances, clinically typical, the culture tubes remained sterile.

(3) That, since the gastric symptoms are in nearly all cases the primary ones, and the convulsions and coma are secondary in time, one would be inclined to infer that the upper part of the digestive tract is first affected, at all events in those who complain of " pain in the stomach," and that absorption may take place there and affect the cerebral and nervous system by way of the blood-stream.

On the other hand, epigastric pain is not complained of by all, and in these the main " point d'appui " of the poison may be the cerebral centres, the vomiting being of cerebral origin equally with the convulsions and coma.

The macroscopic post-mortem appearances in the few cases which I have personally seen (apart from those in which the meningococcus-like organism has been found and the brain and cord and their membranes are the only parts to show morbid changes) support the view that the toxin, whatever its nature, becomes rapidly diffused through the entire body, and affects all the organs, thoracic and abdominal viscera, lymphatic glands, &c.

Of the microscopic changes in the various organs I say nothing; this part of the work will doubtless be detailed by Dr. Seidelin in his report. As stated at the outset, my time has been fully taken up with the bacterial aspect of the disease, and with a few autopsies on patients who died in the Kingston General Hospital. The morbid anatomy has been particularly studied by Dr. Seidelin, who only interested himself in the microbiological results in cases actually coming under his own personal notice, with two or three exceptions.

Appended hereto are the tables showing the influences of age, sex, &c., and finally very brief remarks on each of the cases which have either been seen by me personally, or have been reported to me with details by the various professional men in the country districts. It is on these official reports and on my own personal observations that the foregoing statements have been made.

I have, &c.,

H. Harold Scott, M.D., London,
Government Bacteriologist and Pathologist
to the Kingston General Hospital.

The Honourable,
The Superintending Medical Officer.

Brief Notes of all Cases reported to me as " Vomiting Sickness " since September 30th, 1912.

1. O. L., aged 6 years, referred to on page 13, started as an acute case, but later took on the characters of the subacute and recovered. Meningococcus found.
2. P. McM., aged 4 years, already mentioned (see p. 14), fatal; duration of illness about 9 hours.

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3. V. P., aged 8 years, female. Mentioned p. 14, together with her two sisters.
4. A. P., aged 2 years, and
5. E. P., aged 9 months; all three recovered. Organism found.
6. J. L. B., aged 4 years. Mentioned p. 15. Typical history, but illness ended fatally after 2 hours only. No specimens sent, but "ventricular fluid in excess and turbid."
7. H. L. G., male, aged 3 months. History stated "suddenly attacked with fits, and now and then screamed out." There was no vomiting, and the duration was only half an hour. No specimens sent. I fail to see the reason for reporting this as a case of vomiting sickness.
8. M. B., female, aged $2\frac{1}{2}$ years. Typical history; but duration of illness was only $8\frac{1}{2}$ hours. This patient was said to have been attacked with vomiting sickness last year and recovered. No specimens sent. Report stated that there were petechiæ on pleuræ and in stomach, and that the mesenteric glands were enlarged. No jaundice.
9. C. M., aged 13 years. Mentioned p. 15. Duration 11 hours. There were no post-mortem signs except cerebral ones, fluid (cerebro-spinal) in excess, turbid and "milky," meningococcus isolated. "Fresh cold" as premonitory symptom may have been premeningeal catarrh.
10. C. M. A., aged 4 years. Already mentioned, p. 15.
11. H. W., aged 6 years. Mentioned p. 15. Diplococcus in the primary smears of spinal fluid, but did not develop on cultivation being attempted; possibly dead, as 56 hours elapsed between the death and autopsy.
12. A. J., aged 2 years. See p. 16. Vomiting succeeded by coma, but no history of convulsions. Duration 6 hours. Organism not isolated.
13. I. H., male, aged 3 years. History of diarrhœa for some time (? weeks), no vomiting, no convulsions. Very emaciated. Nothing pointing to "vomiting sickness." Post-mortem signs of enteritis. Reported as vomiting sickness by the parents, because they "had been told that medicine would be given them free at the police station if they reported the child as such a case." Such instances probably account in some measure for the large numbers reported in some out-of-the-way districts with a high percentage of recoveries, many of them not being genuine cases at all of this affection.
14. O. D., female, aged 6 years. Not seen during life, and buried without post-mortem examination. History typical, duration about 18-20 hours.
15. S. A. H., female, aged 3 years. History of abdominal pain, succeeded shortly after by vomiting, convulsions, and coma. Duration same as O. D., No. 14. Many worms found.
16. R. T., aged 6 years. Reported in detail, p. 16. Meningococcæmia and meningitis.
17. D. D., male, aged 11 years. Detailed p. 17. Duration 48 hours.
18. R. E., aged 7 years. See p. 18 for details.
19. D. T., female, aged $3\frac{1}{2}$ years. History of malaise, epigastric pain, and discomfort, no convulsions, no coma. Recovered. There was vomiting of frothy mucus in this case, but no other reason for reporting as true "vomiting sickness."
20. W. T., male, aged 5 years. Same symptoms and history as the last; cleared up after administration of a stomachic mixture.
21. G. A., female, aged $4\frac{1}{2}$ years, same as last.
22. A. S., male, aged $1\frac{1}{2}$ years, same as last.
23. I. S., female, aged 3 years, same as last.
24. A. T. male, aged 14 years. Vomiting, severe headache, rigidity of neck, Kernig's sign present. Meningococcus isolated. Recovered.
25. V. T., male, aged 8 years, brother of last, same symptoms, except Kernig's sign doubtful. Organism present. Recovered
26. R. H., male, aged 8 years. No convulsions, rigidity, or Kernig. No specimens sent. Recovery. Only vomiting; treatment by stomachic mixture. Probably merely gastric upset.
27. L. M., female, aged 10 years. History same as last, but some rigidity.

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28. Mrs. F., adult. Fatal, duration uncertain. Organism isolated from spinal fluid.
29. R. T., female, aged 11 years. Vomiting, headache, slight rigidity, doubtful Kernig's sign. Temperature 101° F., no specimen sent.
30. M. S., female, adult. Gastric symptoms only, no rigidity, Kernig, headache, &c. Cleared up with stomachic mixture.
31. J. McL., female, aged $2\frac{1}{2}$ years. Vomiting, diarrhœa, temperature 100° F. Spinal fluid sterile. Cleared up with medicine. Probably gastro-enteritis.
32. L. M., female, aged 12 years. Same history, treatment, and course as last.
33. W. P., male, aged $5\frac{1}{2}$ years. Abdominal pain, vomit of frothy mucus, slight diarrhœa, severe headache, irritability, Kernig's sign marked. Temperature 102° F., spinal fluid turbid and under pressure. Organism isolated. Smear gave a differential count of 78 per cent. polymorphonuclear leucocytes. Recovery.
34. A. M., female, aged 5 years. Merely vomiting with slight headache. Recovery.
35. D. W., male, aged $3\frac{1}{2}$ years. Duration uncertain. Meninges dull and congested; ventricles distended, fluid turbid slightly. Organism isolated.
36. L. P., male, aged 5 years. Vomiting and convulsions; sudden onset. Fatal in $9\frac{1}{2}$ hours. Nothing found except numerous ascarides and some ankylostomes.
37. R. C. C., female, aged 8 years. History peculiar : Felt ill at 7 p.m., December 29th, 1912, but complained of no pain, and later retired to bed apparently well. Was found unconscious in bed at 3 a.m. (30th), regained consciousness at 5 a.m., and got up and dressed herself. Vomiting came on at 10 a.m., and at 3 p.m. she was drowsy, then convulsions recurred, the child dying comatose at 5 p.m. Several cases showed this condition of partial recovery or amelioration as stated in the general description on page 10 and elsewhere. The spleen was found enlarged, also the mesenteric glands. The dura mater was deeply congested, also the pia, and the surface was dulled; fluid gave a growth of the organism.
38. A. S., female, aged 2 years. Suddenly attacked with convulsions during sleep; never recovered consciousness, and died in 3 hours. No vomiting. Case might be one of ordinary infantile convulsions, due to dietetic error or other common cause. Nothing pointing to true vomiting sickness.
39. I. W., female, aged 4 years. Only convulsions, tongue bitten. No vomiting, no Kernig's sign, no rigidity except during the fits. Spinal fluid sterile. Organs apparently normal, except that there were numerous ascarides. Probably ordinary infantile convulsions, possibly epilepsy associated with ascarides.
40. J. A. D., female, aged 9 years. Complained of abdominal pain and "had fits," but soon recovered and remained well for 4 hours; then vomiting came on with a return of the convulsions, which lasted till death. Total duration 13 hours. Mesenteric glands were enlarged, and there was marked congestion of brain and meninges, but no other abnormality was mentioned in the post-mortem report.
41. I. L. H., female, aged 22 months. Ill only 35 minutes. History of a sudden attack of vomiting, shortly followed by death; no convulsions. Previous health said to have been good.
42. A. C., female, aged $5\frac{1}{2}$ years. Woke from sleep and vomited three times. Again slept, for 6 hours, then was seized with convulsions which continued on and off for 6 hours, when the patient died. Total duration 12 hours. Slight icterus noticed at the autopsy; "spleen twice the natural size," stomach mucous membrane, "red in parts." No specimens sent to the laboratory.
43. H. M. A., female, aged 4 years. Typical history. Duration 12 hours. Only post-mortem changes recorded are slight enlargement of spleen, and congestion of brain surface. No specimens sent.

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44. A. P. D., female, aged 8 years. Went to bed well, but was found unconscious in bed next morning; retching attacks and convulsions with rigidity. Duration uncertain.

45. G. M. F., female, aged 5 years. Typical history. Duration only 8 hours. In this case also the mesenteric glands were enlarged, but the only other abnormality noted was in the head. The vessels were acutely congested, there were exudation of lymph over the surface and extending into the sulci, with cloudy lymph in the ventricles. Spinal fluid yielded the organism.

46. O. B., male, aged 3 years. Vomiting frequent with a state of unconsciousness; no history of fits. Duration 4-5 hours. No abnormality noted according to the post-mortem report. Spinal fluid gave a growth of *B. coli* only.

47. Z. E. J., male, aged 7 years. Typical history. Duration 12 hours. Smears of spinal fluid showed Gram-negative diplococci, and the organism grew well on the nasgar.

48. C. R., female, aged 5 years. Feeling generally ill on January 8th, 1913, and was constantly lying down, and had " a severe cold and running at the nose (? premeningeal catarrh)." Suddenly, at 4 p.m. on January 11th, vomited, three times in all, was very restless and irritable, and shortly after was seized with convulsions, with rigidity and retraction of the head. Total duration about 76 hours; the duration after the sudden attack of vomiting was 8 hours. Spinal fluid gave the organism, which differed, however, in having no action on galactose.

49. M. R., aged 7 years, female. Sister of last. There were no preliminary symptoms. Vomiting began suddenly and lasted for about an hour. Improvement set in, and the child ate a meal and went to bed three hours later apparently well. In another 5 hours vomiting returned with convulsions, coma, rigidity, which terminated fatally after a total duration of 14 hours. The meninges were very congested, dull, and fluid was in excess. Organism seen in smear, but not cultivated.

50. I. V., male, aged 5 years. Typical history. Duration 7 hours. No specimens sent.

*51. B. D., female, aged 4 years. Went to bed quite well; was seized with " fits " at 4 a.m., and died 3 hours later. No jaundice. Spleen showed dark hæmorrhagic spots, and the stomach minute submucous hæmorrhages; mesenteric glands enlarged; kidneys small, hæmorrhages in cortex. Diffuse hyperæmia of meninges of brain; brain itself œdematous, with serous fluid at base. Free flow of fluid by lumbar puncture. Organism grew, but did not act on galactose. This is apparently one of those cases associated with the Gram-negative diplococcus in the cerebro-spinal fluid, but in which certain conditions are found not explicable as due solely to this organism.

*52. V. C., female, aged 2 years. Duration only half-hour. The post-mortem findings will probably be detailed by Dr. Seidelin, who carried out the examination. As regards the intra-cranial condition, the note from the District Medical Officer stated that there was intense congestion of the meninges, especially on convex surface and upper part of the cerebellum, with slight œdema; beginning serofibrinous exudation in median and Sylvian fissures. The organism similar to the last developed, that is, it acidified glucose and maltose, but had no action on galactose.

53. E. S., female, aged 6 years. History somewhat atypical, in that convulsions preceded any vomiting by a period of 8 hours. Duration 11 hours. Liver reddish, congested; spleen similar; mesenteric glands enlarged. Brain merely slight congestion. Free flow of fluid by lumbar puncture. *B. coli* only developed. Nineteen hours or more between death and the autopsy.

54 L. F., female, aged 4 years. Typical history. Duration only 3 hours. Liver purple, congested. Mesenteric glands enlarged. " Free flow of clear, translucent fluid on making lumbar puncture." No growth on culture media.

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55. A. J., male, aged 6 years. Vomiting only. Duration 23 hours.
56. J. J., male, aged 4 years. Vomiting only. Duration 25 hours.
57. M. J., female, aged 10 years Vomited for two or three hours and then recovered. Had diarrhœa also.
58. G. J., male, aged 8 years. Vomited for 2-3 hours, and had diarrhœa, then recovered.

The last four cases all belonged to one family; all started vomiting at about the same time, between 9 and 10 a.m. on the same day. The post-mortem findings in the first two were merely those of gastric and intestinal irritation, while the other two recovered. The symptoms would be equally readily explained by irritating ingesta, which set up severe vomiting, from which the two elder recovered, while the two younger died.

59. I. H., female, aged 3 years. History very indefinite. Appears to have had convulsions for 10 hours, but no other symptoms. Vomited at point of death. Liver said to have been congested and yellow, and conjunctivæ also. But spleen, kidneys, stomach, &c., normal.

*60. A. H., male, aged 4 years. Sudden attack of vomiting at 11 p.m., January 17th. On next day there was marked Kernig's sign, retraction of neck, and convulsions at intervals. Spinal fluid flowed under considerable pressure. A pure growth was given on nasgar of the meningococcus. At the autopsy there was sticky lymph all over vertex of brain, the hemispheres were stuck together by similar lymph, and there were flakes of it in patches over convexity and at the base. At the latter spot were purulent foci.

61. S. B., female, aged 3 years. History uncertain and unreliable. Sister of last case. Fluid in this instance also gave the organism. Brain showed serous meningitis with a few patches of lymph. Duration uncertain, but much shorter than in the case of the brother.
62. I. F., male, aged 5 years. Typical history. Smears of the spinal fluid sent showed nothing definite. Post-mortem only revealed very numerous ascarides, the intestines being " crowded with them singly and in masses."
63. R. F., female, aged 9 years. History typical, with period of amelioration lasting for about 14-16 hours, during which the patient got up and walked about. Organism obtained from the spinal fluid, which flowed freely on lumbar puncture. Post-mortem, no jaundice, liver large, congested, and yellowish on section; mesenteric glands enlarged; kidneys and spleen normal.
64. V. L. C., female, aged 4 years. Sudden onset of convulsions. No vomiting, no paralysis, rigidity. Duration not stated, no specimens sent. I do not know the reason why this case was reported as vomiting sickness.
65. V. F., male, aged 2 years. Typical history. Duration 17 hours. No specimens of any value sent.
66. J. W., male, aged 12 years. Duration 8 hours. History typical. Post-mortem 43 hours after death; decomposition too far advanced for specimens sent to be of any value.
67. D. W., female, aged 10 years. Duration 25 hours. Vomiting for 24 hours incessantly before any convulsions; these only came on for the last hour of life. Specimens useless, as autopsy not performed till 52½ hours after death.
68. A. R., female, aged 24 years. This was reported as a case of vomiting sickness, but the patient was six months pregnant, vomited severely, aborted, and died. No growth obtained from the culture of spinal fluid sent, but there was said to be intense congestion of the cerebral meninges, with fibrinous exudation over the surface.
69. C. R., female, aged 3 years. Always sickly; vomiting was the only symptom noted, and lasted for 18 hours, when death took place. " Nothing particular post-mortem."
70. L. I. R., female, aged 3½ years. Typical history, duration 14 hours. Post-mortem useless, too long after death.

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*71. J. J. G., male, aged 8 years. Typical history; duration 10 hours. Culture of organism obtained, but galactose negative.

*72. H. S., female, aged $3\frac{1}{2}$ years. No history given. Diplococcus obtained.

*73. A. S., male, aged $3\frac{1}{2}$ years. Gram-negative diplococcus obtained, but growing in chains and only acting on glucose. May have been of extraneous origin. History of having eaten "physic nut." This is, I believe, the *Jatropha curcas*, not uncommonly eaten by children in Jamaica; it sets up considerable gastro-intestinal irritation.

*74. S. S., female, aged 3 years. A playmate, if not a relative, of the last-named. Same history, but this child was not nearly so collapsed as the last. No spinal fluid taken. Vomited freely and recovered in an hour.

*75. A. W., female, aged 20 months. Sent up as a case of vomiting sickness, but there was none after admission, no convulsions, no cerebral symptoms at all. Possibly a gastric upset from dietetic error, teething, &c.

76. F. B., male, aged $1\frac{1}{2}$ years. History quite indefinite. Several attacks of vomiting for about 8 hours, succeeded by convulsions, which came on 4-5 hours before death. No specimens sent, and everything described as normal in the post-mortem examination.

*77. E. M., female, aged 3-4 years. Typical history. Duration about 12 hours. Except for a little congestion of the gastric mucous membrane and a few petechiæ, and a similar condition in the small intestine, nothing abnormal was noted. Organism isolated from the spinal fluid, but the reaction with galactose was delayed.

78. I. B., female, aged 5 years. Typical history, but no coma. Patient recovered. Organism obtained from spinal fluid.

79. E. S., male, aged 7 years. Only symptom given was vomiting. No convulsions. Liver enlarged, yellowish, slight hyperæmia of stomach, mesenteric glands enlarged.

80. M. C., female, aged $3\frac{1}{2}$ years. Typical, but very acute; duration 4 hours. No specimens sent, but stomach said to have been hyperæmic with ecchymoses along lesser curvature, and mesenteric glands much enlarged. Several trichocephali.

81. L. F., female, aged 4 years 10 months. Vomiting, convulsions, coma. Duration 6 hours. Cerebro-spinal fluid abundant. No growth on medium.

*82. B. W., male, aged 12 years. Ill for a week or more with fever, delirious. Temperature 100° F. Blood showed abundant crescents. Post-mortem showed spleen dark, greyish black, and liver similar, neither enlarged. Cerebral meninges very congested, with thick lymph over vertex, and purulent patches between hemispheres; at base, greenish yellow pus. Ventricles bulging, each containing 5-6 ounces of turbid fluid. Smears showed plentiful intracellular diplococci, and a typical growth developed on the culture medium.

*83. M. H., female, aged 27 years, mother of No. 81. Vomiting for 36 hours, delirious. No other sign or symptom. Had complained of headache. Post-mortem showed acute nephritis and an enlarged, fatty liver.

84. J. J., male, aged 5 years. Reported as vomiting sickness, but history very indefinite. Vomited for 36 hours, no other symptom apparently. Nothing abnormal found post-mortem except 30 ascarides in small intestine.

*85. D. B., female, aged 9 months. History typical of meningitis. Rigidity of limbs, retraction of neck, Kernig's sign marked, vomiting, convulsions. Meningococcus obtained. Duration less than 24 hours.

86. E. W., female, aged 35 years. Malaise for 3 days before a sudden onset of headache and vomiting, succeeded by coma 9 hours later; no mention of convulsions. No specimens.

87. E. W., female, aged 60 years. Said to have had vomiting and coma. No specimens sent, no duration mentioned.

88. T. C., female, aged $2\frac{1}{4}$ years. Typical history. Duration 14 hours. No specimens sent. Post-mortem report stated: "All the organs appeared healthy, and I am at a loss to account for the vomiting, convulsions, or coma."

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89. J. H., female, aged 6 years. Vomiting, frontal headache, and coma. Duration 12-14 hours. Coma came on after one hour's vomiting and headache, there were no convulsions. Post-mortem there were a few submucous hæmorrhages towards cardiac end of stomach, kidneys were congested, and the intestines contained 30 ascarides. Spinal fluid turbid. The culture only showed staphylococci and *B. coli* colonies.

90. F. P., female, aged 3 years. Typical history. Duration 12 hours. Liver purple with yellow patches. Mesenteric glands enlarged. No jaundice. Gram-negative colonies developed from the spinal fluid culture tube, but the reactions of these and the characters of the growths and subcultures were those of *M. catarrhalis,* and not the meningococcus; probably merely an adventitious contamination when making the culture.

91. I. B., female, aged 3 years. Vomiting apparently the only symptom; no other mentioned in history of this patient. Duration 4 hours. No specimen sent, every organ stated to be normal at the autopsy.

92. U. C., female, aged 3 years. Duration 9 hours. History of vomiting and "fits." Every organ reported normal.

93. J. E. S., male, aged 22 months. Indefinite history sent of screaming, vomiting, and "fits." Duration 17 hours. Everything stated to be normal at the autopsy except that the cerebral ventricles were distended with "clear fluid containing a few flakes." No specimen sent.

94. A. B., female, aged 3 years. History of 1 hour's vomiting and fits. Nothing else stated. Post-mortem, fresh pleuritic adhesions on right side and one or two round worms in the intestines. No specimens sent. Everything else stated to be normal.

95. Z. C., female, aged 4 years. Had an attack of vomiting at 3 p.m., January 31st, then apparently recovered and slept well that night and till 5 a.m. next morning, when convulsions set in and lasted till death, at 3 p.m. Duration 24 hours.

96. G. A. M., female, aged 9 years. History of vomiting, convulsions, coma, and cerebral irritability; temperature 96·4° F. Post-mortem report and specimens appear to have been lost in transit. They did not reach the laboratory, though the medical man who saw the case remembered sending them.

*97. C. N., male, aged 5½ years. History of vomiting and troublesome retching. Intense drowsiness and weakness, no convulsions, coma, rigidity, headache, or pain. About 50-60 ascarides found post-mortem, also horseshoe kidney and accessory spleen. Spinal fluid merely gave a Gram-negative bacillus, probably a post-mortem contamination.

*98. A. N., male, aged 12 years. Sudden vomiting, slight frontal headache, and drowsiness. No convulsions, coma, &c. Recovered after 48 hours. Brother of last. Spinal fluid culture remained sterile.

*99. C. N., aged 9 years. Same symptoms as in last case, but terminated fatally. Duration 20 hours. This and the previous two were brothers. All three began to vomit at same time, and the father is said to have "felt ill" for 24 hours, but then recovered. Spinal fluid taken from No. 99, but only a short thin Gram-negative bacillus developed. All three may have been cases of ptomaine poisoning, or a Gaertner bacillus infection.

*100. E. B., aged 2 years. History peculiar: had been ill, but not seriously, for some 3 months. About 2 weeks before death he "began to swell." On February 3rd he "became worse and refused food." Went to bed 8 p.m., but next morning was not able to get up, and could not drink. He then became very stiff and died at 11 a.m., February 4th. At the autopsy there was noticed to be a "scaly eruption of skin over whole body." The liver was "greyish, with few yellowish patches on surface, tissue uniformly greyish." Pia mater hyperæmic, with small collection of turbid fluid at base of brain. Spinal fluid flowed freely from lumbar puncture. Culture gave a typical growth of Gram-negative diplococci which yielded the typical sugar reactions. No mention is made of any inflammatory condition of the kidneys, but the history, the scaly eruption,

and the swelling would point to nephritis in association with scarlet fever as a precursor of a meningeal affection.

*101. E. B., aged 6 years. Usual history. Duration about 18 hours. Many ascarides post-mortem, and petechiæ at lesser curvature. Practically nothing else abnormal. No specimens.

102. L. A. McG., male, aged 3 years. Reported as a case of vomiting sickness, but the history is of a sudden attack of vomiting one night, without any other symptoms, and there was prompt recovery. There was no headache, no convulsions. He only brought up food taken at his last meal.

*103. G. B., female, aged 16 months. History fairly typical, duration 37 hours. Spinal fluid culture gave two kinds of organism; one gave the reactions of the diplococcus mentioned, the other was a motile sporing bacillus, doubtful Gram-staining.

*104. H. M., male, aged 19 months. History typical, but duration 45-50 hours. Post-mortem : the only abnormal conditions found were distension of the cerebral ventricles with turbid fluid, and at the base was a thick layer of lymph shutting off the spinal canal, as it were, by a diaphragm. Attempts at lumbar puncture during life had been fruitless. Smears of the cerebro-spinal fluid showed well-marked intracellular diplococci, and the culture of the intraventricular fluid yielded a pure and copious growth of the meningococcus.

105. A. F., female, aged 25 years. History of vomiting, convulsive movements, headache, and general irritability. Was ill for 6 days and then slowly recovered. No specimens sent.

*106. C. C., male, aged 20 years. History quite unlike the usual. Said to have suffered from nausea and fever for two weeks prior to more violent vomiting, which continued for 3-4 days before terminating fatally. Vomit yellow, then green, and lastly said to have been black, but when seen by the medical attendant it was green. Temperature normal, pulse 90-96. Face puffy; slight jaundice of scleræ, of skin, became of the natural tint of a Chinaman's skin. No headache, no convulsions, no retraction, breathing stertorous, coma preceded death. This man was a very heavy drinker at all times and apparently quite impartial; whisky, beer, tea, brandy, rum.

The morbid anatomy will be described in Dr. Seidelin's report, for he performed the autopsy. Two cultures were taken, one of the spinal fluid which remained sterile, and one of the intraventricular fluid, from which a Gram-negative cocco-bacillus developed.

*107. P. B., male, aged 11 years. Vomited for 36 hours, but had no convulsions. Autopsy showed petechiæ over surface of the left ventricle of the heart, and at the lesser curvature of stomach. Liver reddish-grey, with yellowish patches. Duration of illness 36 hours. No culture made.

*108. E. M., female, aged 11 years. Vomiting for 24 hours, then, with cessation of this, convulsions supervened. Duration 25 hours. Except for enlarged mesenteric glands all thoracic and abdominal viscera were normal. There was diffuse hyperæmia and œdema of pia mater, and fibrino-purulent exudation around some of the vessels of convexity. No fluid obtained by lumbar puncture for culture.

109. H. P., male, aged 2 years. History of convulsions only, no vomiting. I fail to see why this case was reported as one of vomiting sickness.

110. D. P., male, aged 4 years. Typical history. Duration $14\frac{1}{2}$ hours. Cerebro-spinal culture showed colonies of Gram-negative diplococci, but they did not grow on subculturing.

111. D. D., male, aged 10 years. Typical history. Duration $14\frac{1}{2}$ hours. At autopsy there was said to be marked jaundice, stomach hyperæmic at cardia, with some petechiæ, mesenteric glands enlarged, liver purple-grey. Many ankylostomes. The dura mater was hyperæmic, the pia cloudy and intensely hyperæmic, with lymph deposits over parietal region, and much fluid. Free flow on lumbar puncture. Culture again here showed Gram-negative cocci, which did not develop on subculture.

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*112 U. M., male, aged 8 years. One of those cases showing the period of amelioration. Total duration 33 hours, with an interval of 18 hours during which the patient felt well enough to get up and eat his meals. Then the vomiting suddenly returned and coma rapidly supervened, in which condition the child remained till death. Duration after the interval $14\frac{1}{2}$ hours. Culture from the spinal fluid gave Gram-negative diplococci, which acted typically on the various sugars.

113. O. G., male, aged 5 years. Typical history. Duration 8 hours. " Meninges dull and congested markedly, fluid flaky." No specimens sent.

114. C. B., male, aged 4 years. Typical history. Duration 14 hours. No cultures.

115. I. S., female, aged 2 years. Sudden onset of convulsions, no vomiting. Death after 12 hours. No specimens reached me from this case, though they were said to have been sent.

116. I. B., female, aged 40 years. Vomiting the only symptom, death in 27 hours. Each adrenal contained a cyst with blood (2 drachms). Spinal fluid in excess and turbid. No specimens sent. Apparently no other abnormality noticed.

*117. E. M. Y., female, aged $2\frac{1}{2}$ years. Vomiting and convulsions, and death in 5 hours. Lymph-glands generally enlarged and hyperæmic, also the spleen. Two culture-tubes of spinal fluid taken; one remained sterile, the other developed one colony only, and that a Gram-negative bacillus.

118. P. B., female, aged 4 years. Total duration 16 hours, with an interval of improvement of 11 hours, before the final exacerbation, which led to a fatal termination. At the post-mortem nothing except general congestion of all the organs and an enlarged spleen were found. No specimens.

119. E. McD., male aged 6 years. Typical, but rapid; duration $3\frac{1}{2}$ hours. Stomach hyperæmic, also upper part of duodenum, which contained partly digested blood. Brain and cord normal.

120. G. McD., female, aged 9 years. Same history of vomiting, but no convulsions; same post-mortem conditions. Duration 40 hours.

121. L. L., female, aged 12 years. Lived in same house as the last two cases; symptoms similar but still more prolonged, lasting 76 hours. Vomiting, no headache, no pain, no convulsions, but restless and semi-comatose. Ecchymoses were found on posterior aspect of the heart; liver pale, mottled; many ascarides in small intestine, mesenteric glands enlarged.

122. Another occupant of same house (P. H., aged 13 years) had an attack of vomiting but recovered.

*123. M. B., male, aged 3 years. Typical history. Duration uncertain. From the spinal fluid developed a few colonies of large, Gram-positive, motile, sporing bacilli.

*124. C. W., female, aged $2\frac{1}{2}$ years. Sudden onset of vomiting, followed by general convulsions and coma. Kernig's sign was present. Duration $4\frac{1}{2}$ hours. Cultures of heart blood were sterile; of the cerebro-spinal fluid gave colonies of Gram-negative diplococci in groups, which acidified glucose, maltose, and galactose in 24-48 hours, the remainder being unaffected till after 4 days, when they also were rendered acid, namely, lactose, saccharose, and mannite.

*125. C. B., female, aged 2 years 8 months. Had a " slight cold " for 24 hours, then " became very ill, vomited, had convulsions, and died." Duration uncertain. Culture taken of the spinal fluid gave typical diplococci, which acidified maltose and dextrose, but not galactose.

126. G. T., male, aged 5 years. Had convulsions and died in 13 hours. Kernig's sign said to have been present. There was no vomiting, but it had been, nevertheless, reported as a case of the disease. No specimens sent.

*127. E. P., male, aged 2 years. Typical history. Duration 3 hours. Post-mortem revealed tubercular affection of the lungs and bronchial glands, also the kidneys. Spinal fluid cultured and showed a mixture of staphylococci, Gram-negative diplococci, and Gram-negative bacilli. The

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diplococcus on being isolated and subcultured acidified dextrose, maltose, and galactose.

128. E. A. W., female, aged 22 months. Typical, but duration only 4½ hours. "Nothing abnormal found except intense congestion of pia." Culture sterile.

129. T. E., female, aged 13 years. Slight vomiting, then improvement for 19 hours, after which patient rapidly lapsed into unconsciousness and died 7½ hours later. Practically the only pathological changes were: marked hyperæmia of meninges and cloudiness of pia; exudation of lymph on convexity and at base of brain. Free flow of fluid by spinal puncture Culture showed well-marked colonies of Gram-negative diplococci, which, however, did not grow on subculture.

130. M. B., female, aged 4 years. Duration 11 hours. Microbiological results similar to the last.

*131. B. M., female, aged 11 months. Duration 2 hours. Stomach showed large hyperæmic patches, with numerous petechiæ along lesser curvature. Diplococcus developed from the spinal and ventricular fluids, which acidified dextrose, galactose, and maltose, and after 4 days the lactose was also slightly changed.

132. E. A., female, aged 3 years. Convulsions only, no vomiting. Duration 8 hours. I fail to see in this case, again, the reason for reporting as "vomiting sickness."

*133. T. J., male, aged 12 years. Found dead in bed, after retiring the previous evening in apparently normal health. The same remarks apply to this case as were made concerning the last.

134. T. T., male, aged 2½ years. Seized with convulsions during sleep, and died in a little under 2 hours. Nothing found except some hyperæmia of stomach posteriorly and fine ecchymoses, and 12 ascarides in intestine. Possibly reported as vomiting sickness because of the succeeding three cases which occurred in the same house.

135. J. L., female, aged 30 years. Vomiting, diarrhœa, and severe abdominal pain. Recovered.

136. B. T., female, aged 4 years. Vomiting and collapse of sudden onset. Quite well next day.

137. J. T., male, aged 5 years. Acute onset of vomiting and diarrhœa, which terminated fatally in 24 hours.

138. I. E., female, aged 6 years. Convulsions, no vomiting. Death 22 hours after onset. Reported as vomiting sickness by the medical attendant. No specimens sent.

*139. M. A. W., female, aged 3¼ years. Duration 14½ hours. History not quite typical. Convulsions were first symptom, and after 3 hours they passed off for an interval of 5 hours, when they returned with vomiting, succeeded by coma. On hæmoglobin-agar a Gram-positive bacillus developed from the cerebro-spinal fluid, which flowed freely on lumbar puncture.

140. M. R., female, aged 7 years. History of convulsions only, no vomiting. Specimens sent of spinal fluid—no growth.

*141. J. E., male, aged 6 years. Convulsions and coma, no vomiting. Slight icterus reported, and at post-mortem the axillary, cervical, and inguinal glands were found enlarged and hyperæmic. No other abnormality. Spinal fluid yielded a growth of a long, Gram-negative bacillus, probably an accidental contamination. Duration of illness 24 hours.

*142. E. E., female, aged 20 years. Similar symptoms to last; no vomiting. Duration 24 hours. Why vomiting sickness?

*143 D. A., female, aged 7 years. No vomiting; complaint of abdominal pain and general malaise; convulsions followed and death occurred 15 hours after the onset. The lymph glands were found enlarged in this case also. From the culture of the heart blood there developed a long, Gram-negative bacillus (probably an accidental contamination), and from the

cerebro-spinal fluid a short thick, Gram-negative bacillus which acidified all sugars.

144. A. B., male, aged 5 years. Convulsions, retraction, &c., but no vomiting. Duration 6 hours. From the spinal fluid small translucent colonies developed, consisting of Gram-negative diplococci, which acidified dextrose, maltose, and galactose, but not affecting lactose, saccharose, or mannite. This case was, therefore, associated with an organism giving the morphological and other characters of the meningococcus, but there is no apparent reason for calling it vomiting sickness.

145. E. P., female, aged 27 years. History of vomiting and death in 9 hours. No other symptoms recorded. No specimens.

146. F. E., male, aged 3 years. Typical history, but duration only 2 hours. Post-mortem carried out 30 hours after death. Gram-negative bacillus and Gram-negative diplococcus developed from the spinal fluid taken at the autopsy. On subsequent testing, the former turned out to be merely *Bacillus coli*, and the latter *micrococcus catarrhalis*. The former probably a post-mortem infection, the latter a contamination from the air in taking the specimen.

*147. A. T., male, aged 6 years. Typical history. Duration about 48 hours. At autopsy the cervical, axillary, and inguinal glands were enlarged and hyperæmic; organs generally a little hyperæmic, and the liver fatty and friable. The left ventricle of the brain contained a small amount of slightly turbid fluid, which on cultivation yielded the diplococcus, which acidified dextrose and maltose, and 24 hours later galactose, while the rest were unaffected. This, then, is another instance in which a meningococcus or closely allied organism was present, probably in association with some other, for that alone would not set up the liver and general glandular conditions.

148. B., aged 2½ years. No history sent. Glands enlarged as in last case. Microbiology yielded nothing of importance.

149. T. E. S., female, aged 4 years. Typical history; duration 8 hours. Stomach hyperæmic, with ecchymoses at cardia. Ascarides and trichocephali present in small intestine. Nothing particular noticed at the autopsy, except these.

*150. C. W., female, aged 30 years. This was a peculiar case. The history stated that the patient had complained at intervals of pain in her chest. About 10 hours before death she was seized with an attack of vomiting, later had convulsions, succeeded by coma and death. At the autopsy tuberculosis was present in the lungs, the kidneys showed acute nephritis, and the uterus contained a sarcoma the size of an orange. Cultures of the heart blood yielded only staphylococci, and those of the spinal fluid, which flowed very readily on lumbar puncture, (about 60 c.c were obtained) remained sterile for 4 days, when a diphtheroid organism developed (probably a contamination).

151. M. C., female, aged 11 months. Vomiting, convulsions, coma, persistent nystagmus, retraction of neck. Duration 2 days. Spinal fluid culture gave colonies of the diplococcus described.

152. W. W., male, aged 3 years. Vomiting and convulsions, followed by death in 1 hour. No abnormality detected at post-mortem, except that the spinal fluid was turbid. From this a Gram-negative diplococcus was cultivated which acidified dextrose, maltose, galactose, and mannite.

*153. C. W., male, aged 12 years. Duration about 60 hours. The only symptom reported was severe abdominal pain. No history of vomiting or convulsions. The mesenteric, mediastinal, and axillary glands were enlarged and hyperæmic, and the mucous membrane of the stomach showed small hæmorrhages at the cardia. The spinal fluid was very viscid, and the cultures of it remained sterile. Why this was reported as a case of vomiting sickness I am unable to say.

154. M. G., female, aged 7 years. Typical history. Duration 6 hours. No abnormality reported as seen post-mortem except intense congestion of

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the meninges, especially the pia. Cultures of the spinal fluid were sent, but remained sterile.

155. E. G., female, aged 10 years. Sister of the last. Same history, but duration 9 hours. From the fluid in this case the diplococcus already frequently described developed, but the change effected in galactose was very slight.

156. E. H., female, aged 9 years. Typical history. Duration 30 hours. Submucous hæmorrhages were found post-mortem at the cardiac end of the stomach. Culture of the spinal fluid gave the diplococcus, but it had no action on galactose.

157. E. M., female, aged 11 months. History typical, but rapid sequence of events, death in 3 hours. Half-sister of the last case. The spinal fluid in this case was turbid and flaky, and from it developed the diplococcus which, in this instance, acidified galactose also.

*158. R. A. L., female, aged 9 years. History of convulsions only; no vomiting. Duration 6 hours. Spinal fluid was clear, but blood-stained. Cultures of it remained sterile. There were several interesting morbid anatomy changes present, which will probably be described by Dr. Seidelin, as he performed the autopsy.

159. C. T., male, aged $2\frac{1}{2}$ years. Convulsions, coma, retraction of head, Kernig's sign present, but there was no vomiting. This patient recovered, and no specimens were sent. It had, however, been reported by him as a case of vomiting sickness. It certainly may have been a case of meningitis, but apart from this I do not understand the reason for calling it vomiting sickness, as the prominent symptom was altogether absent.

160. U. W., female, aged 7 years. History uncertain, was found in convulsions. No mention of vomiting. At the post-mortem the meninges were congested and dulled, and in parts adherent to brain. Culture of the spinal fluid was grossly contaminated. The same remarks apply to this as to the last case.

161. D. H., male, aged 3 years. Typical history. Duration 2 hours. Spinal fluid uniformly turbid; culture gave a typical growth of the diplococcus. But this can only have been part cause, for the myocardium showed small petechial hæmorrhages; the spleen was enlarged, as were also the mesenteric glands.

162. C. G., male, aged 6 years. Symptoms typical, with an interval of improvement lasting some 6-8 hours. Total duration about 16 hours; duration of the second exacerbation 5 hours. Liver and spleen were both enlarged, the stomach was congested, and showed small petechial hæmorrhages; mesenteric glands enlarged. Cerebral meninges were intensely congested, with deposits of flaky lymph on the convexity of the brain. Fluid uniformly cloudy. Growth of the same organism obtained on nasgar.

163. W. C., male, aged 19 months. Vomiting, followed almost at once by convulsions, and terminating fatally in 1 hour. There was a tubercular deposit in the right lung, small petechial hæmorrhages on the myocardium, and enlargement of the mesenteric glands. Culture of the spinal fluid gave a growth of *B. coli* only.

164. P. H., male, aged $2\frac{1}{2}$ years. Sudden attack of vomiting after a meal of "dumplings and green bananas," then improvement for about 6 hours, with a return of vomiting, accompanied by convulsions, till death 5 hours later. The stomach was intensely congested, and showed petechial hæmorrhages. Vessels of meninges and brain congested, fluid slightly but uniformly turbid (post-mortem 23 hours after death), but culture remained sterile. ? Acute gastritis with convulsions in a young child after a meal of unsuitable food.

165. L. S., female. aged 4 years. Usual history; duration 11 hours. The only abnormalities reported at the post-mortem were enlargement of spleen and mesenteric glands, engorgement of vessels of meninges and brain, and the cerebro-spinal fluid was slightly cloudy. A smear from the latter showed some Gram-negative diplococci and bacilli, but the culture yielded only *B. coli*. Fifty-three hours elapsed between death and the autopsy.

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166. C. C., male, aged 6 years. Vomiting only mentioned, no statement as regards convulsions. Started at 6 p.m., but after 2 hours improved and ate a good meal, and slept well till early morning, when the vomiting returned and continued till death at 6 a.m. Total duration, therefore, 12 hours; duration of the second attack about 2 hours. At post-mortem the only abnormality noted was deep congestion of the brain, and exudation of lymph in the sulci; the fluid was slightly turbid. Culture remained sterile.

167. L. C., female, aged 3 years. Sister of the last. History of a "slight cold in the head for a few days before taking seriously ill." Then suddenly vomiting occurred accompanied by fits. After this had gone on for 3 hours the mother took the child from bed to carry it to a doctor, but it died on the way. Duration 6½ hours. No abnormality found anywhere except in the head. No enlarged glands, &c. The brain generally was deeply congested, and exudation of lymph was present in the sulci, the fluid obtained by lumbar puncture was "turbid and slightly flaky." Smears of the fluid showed Gram-negative diplococci and a few staphylococci (probably from the skin). The culture gave a fairly abundant and pure growth of the diplococcus already described, which acidified dextrose, maltose, and galactose, but none of the others in which it was placed.

168. K. R., male, aged 4 months. Was put to bed apparently well, and was found unconscious and "retching" at 2 a.m. Is said not to have had any convulsions. Duration uncertain. At post-mortem the tracheal glands were found enlarged, also the mesenteric glands, and intestinal lymphoid tissue. The meninges were intensely congested, and the ventricles distended with clear fluid of a pale yellow colour. The culture of this remained sterile.

169. L. R., female, aged 40 years. A relation of the last and in the same house. Vomiting for about 4 days, later comatose; history does not mention convulsions. Duration about one week. The only post-mortem signs of importance were enlargement of liver and cerebral conditions. The meninges were congested and dulled all over the brain, and the "convolutions were matted together at the vertex." The ventricles were distended with fluid, and that taken by lumbar puncture was uniformly turbid. A smear of this showed diplococci; a differential count of the cells gave polymorphonuclears 78 per cent., lymphocytes 17 per cent., endothelial 5 per cent. Culture yielded a typical growth of the diplococcus.

170. H. W., male, aged 4 years. Typical history; duration 12 hours. The post-mortem showed very little; one or two small hæmorrhages in heart muscle, and the liver was described as "brick-coloured." The meninges were "very congested and dulled; ventricles were not distended, but contained some clear fluid." No specimens received from this case.

171. I. W., male, aged 2 years. The history was very meagre; merely "vomiting, fits, and coma." Death in 2 hours. Spinal fluid flowed freely and was clear. Everything was described as normal at the post-mortem, and no specimens were received.

172. J. T., male, aged 4 years. Vomited once only, then was seized with convulsions, which continued till death, which took place in 2 hours., All the viscera described as normal. Cerebral ventricles distended with clear fluid; free flow on making lumbar puncture. Culture sterile.

173. G. J., male, aged 4 years. Complained suddenly at midnight of pain in the head, vomited and died in an hour. At the autopsy the glands at the bifurcation of the trachea were found enlarged and caseous; two feet of the small intestine were "packed with round worms," and the mesenteric glands were enlarged. Whole surface of the brain showed extreme congestion; no exudate. Ventricles full of pinkish, turbid fluid. Free flow of spinal fluid, clear. Culture was very contaminated, but showed diplococci, which, however, on subculture after plating for isolation, proved to be merely *micrococcus catarrhalis*.

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174. I. S., female, aged 3 years. Vomiting followed by convulsions with retraction. Duration 6 hours. Stomach congested and showed "several linear hæmorrhages." Cerebral meninges intensely congested; membranes adherent over top of right ascending parietal convolution. Brain matter congested and showing several punctiform hæmorrhages. Spinal fluid sent, but culture tube remained sterile.

*175. I. R., female, aged 4½ years. No history of vomiting in this case. Complaint of abdominal pain, which became easier, and patient slept for some 8 hours. Then awoke screaming, became convulsed, and shortly afterwards comatose. Total duration about 14 hours; duration after second exacerbation 6 hours. At the post-mortem examination the cervical axillary and inguinal glands were all enlarged, and the liver was "purple with yellowish patches." Spinal fluid was taken but no organisms developed.

176. M. H., female, aged 10 years. Typical history, but duration longer than the average, namely, 29 hours. Liver was found after death to be enlarged; spleen normal; stomach congested, especially at cardia. Kidneys congested. Lymph glands not enlarged. Pia mater congested; ventricles contained clear fluid; brain substance appeared natural. A culture tube inoculated with heart-blood was sent; this showed only staphylococci and *B. coli.* Spinal fluid was not obtained.

The remaining seven cases, making up the total of 183, have not been described here; they were referred to in my previous report and occurred prior to the 30th September, 1912.

Table I.

Under 1 year.	Between 1 and 2 years.	2–3 years.	3–4 years.	4–5 years.	5–6 years.	6–7 years.	7–8 years.	8–9 years.	9–10 years.	10–11 years.	11–12 years.	12–13 years.	13–14 years.	14–15 years.	15–16 years.	16–17 years.	17–18 years.	18–19 years.	19–20 years.	20–30 years.	30–40 years.	40–50 years.	50–60 years.	"Adult," age not stated.	Total.
6	19	29	32	18	16	8	8	8	5	5	7	3	1	—	1	—	—	1	2	6	3	—	1	4	183

Showing the ages of all patients reported as "vomiting sickness" cases.

Of the total number of cases, 120, or 65·57 per cent., occurred in children under the age of 6 years.

Table II.

Under 1 year.	Between 1 and 2 years.	2–3 years.	3–4 years.	4–5 years.	5–6 years.	6–7 years.	7–8 years.	8–9 years.	9–10 years.	10–11 years.	11–12 years.	12–13 years	13–14 years.	14–15 years.	15–16 years.	16–17 years.	17–18 years	18–19 years.	19–20 years.	20–30 years.	30–40 years.	40–50 years.	50–60 years.	"Adult," age not stated.	Total.
5	6	4	8	5	5	2	5	2	1	1	2	1	1	—	1	—	—	1	—	—	1	—	—	1	52

Showing the number of cases in which a Gram-negative diplococcus was isolated from the cerebro-spinal fluid.

Table III.

Ages.	Under 1 year.	Between 1 and 2 years.	2–3 years.	3–4 years.	4–5 years.	5–6 years.	6–7 years.	7–8 years.	8–9 years.	9–10 years.	10–11 years.	11–12 years.	12–13 years.	13–14 years.	14–15 years.	15–16 years.	16–17 years.	17–18 years.	18–19 years.	19–20 years.	20–30 years.	30–40 years.	40–50 years.	50–60 years.	"Adult," age not stated.	Total.
Males...	1	12	12	14	13	9	3	5	2	1	2	5	2	—	—	—	—	—	—	1	—	—	—	—	2	84
Females	5	7	17	18	5	7	5	3	6	4	3	2	1	1	—	1	—	—	1	1	6	3	—	1	2	99

Showing the influence of sex in the incidence of cases of "vomiting sickness."

Under the age of 5 years there were 52 of each sex.

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Table IV.

Ages.	Under 1 year.	Between 1 and 2 years.	2–3 years.	3–4 years.	4–5 years.	5–6 years.	6–7 years.	7–8 years.	8–9 years.	9–10 years.	10–11 years.	11–12 years.	12–13 years.	13–14 years.	14–15 years.	15–16 years.	16–17 years.	17–18 years.	18–19 years.	19–20 years.	20–30 years.	30–40 years.	40–50 years.	50–60 years.	"Adult," age not stated.	Average.*
Males...	1	12½	5	9	15½	16	20	11	19	14	40	—	11	—	—	—	—	—	—	—	—	—	—	—	—	14½ hours.
Females	19	9½	7½	11½	7	14	9	15½	18	17	25	—	7½	—	—	12	—	—	—	24	21½	—	—	—	—	14½ hours.

* Prolonged cases, lasting over 3 days, are not "ordinary," and are not reckoned in the above. There was one of 3½ days, two of 4 days, and one of 2-3 weeks. (Speaking generally, neither age nor sex has any appreciable effect as regard duration.)

Showing the duration of illness in the ordinary acute cases of "vomiting sickness."

Tabular Statement of Work done at the Laboratory between October 1st, 1912, and March 31st, 1913.

Widal blood-serum reactions	568
Blood examinations for malarial parasites	502
Fæces for ankylostome and other ova	749
Specimens of urine examined	128
Pus examinations for organism	71
Sputum examinations	128
Vaccines prepared	51
Waters, bacteriological analyses	64
Tissues for section	40
Rats dissected for suspicion of plague	238
Post-mortem examinations, special	48
Miscellaneous, including examinations of gastric contents, blood-cultures, throat swabs, inflammatory fluids, &c. ...	253
Examinations of smears, cultures, &c., in connection with "vomiting sickness"	341
Total	3,181

No. 9.

JAMAICA.

The GOVERNOR to the SECRETARY OF STATE.

(Received 7 October, 1913.)

Sir, King's House, Jamaica, 19 September, 1913.

I have the honour to acknowledge the receipt of your circular despatch, dated the 19th of March last,* transmitting copies of the report of the Advisory Committee for the Tropical Diseases Research Fund for the year 1912,† and in compliance with the request in the second paragraph of your despatch to forward herewith, for communication to the Committee, a copy of a letter from Dr. W. D. Neish, Medical Officer in charge of the Lepers' Home and Public General Hospital, Spanish Town, together with a copy of a letter from Dr. T. M. Bartlett, District Medical Officer, Morant Bay, containing their observations on the report.

* Not printed. † [Cd. 6669], March, 1912.

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2. Dr. Scott, the Government Bacteriologist, has asked that his half-yearly reports may be printed as his contribution to the volume. These reports have from time to time been forwarded to you for the information of the Committee, the last having been sent under cover of my despatch dated the 15th of April last.*

I have, &c.,
W. H. MANNING,
Governor.

Enclosure 1 in No. 9.

From Dr. W. D. Neish, District Medical Officer, Spanish Town, to the Superintending Medical Officer.

Sir, Spanish Town Hospital, August, 1913.

I have the honour to acknowledge the receipt of Circular 1691, dated the 30th July, 1913, forwarding a copy of the report of the Advisory Committee for the Tropical Diseases Research Fund for 1912, and in reply beg to submit the following observations :—

The Tabanidæ of Jamaica.

For the past five years I have been collecting diptera for the authorities of the British Museum, and I am now able to compile a classified list of tabanidæ so far known to occur in the Island.

(1) Chrysops horse-fly, described by Williston and Townsend.
(2) *Lepidoselaga lepidota*, Wiedemann. The matuca fly of Brazil, called the "scourge of the Amazon," unknown in Jamaica until discovered by me in St. Catherine.
(3) *Tabanus alene*, Townsend. Described in the Transactions American Entomological Society, Vol. xxii., fol. 59.
(4) *Tabanus augustifrous*, Townsend, ibid.
(5) *Tabanus lucidulus*, Walker, List 1.188.
(6) *Tabanus obliquns*, Walker. Described in *Diptera Saundersiana*, 28.
(7) *Tabanus rufiventris*, Walker, List 1.180.
(8) *Tabanus trilineatus*, Latreille. Described as occurring in Brazil. Unknown in Jamaica until found by me in St. Catherine. Mr. Austen informs me that my specimen is the first that has been received in the British Museum for over 40 years.
(9) *Tabanus parallelus*, Walker, List 1.187. Also unknown in the Island until identified by Austen from a specimen sent by me to the Museum.

With the exception of *Chrysops costatus* all the tabanidæ are exceedingly rare in Jamaica. It is very difficult to obtain specimens. So far as is known none transmit any disease.

Malaria.

In 1910 I captured two species of true anopheles hitherto unknown in Jamaica.

1. *Anopheles vestilipennis*, nov. sp., Dyan and Knab. The original description appeared in "Proceedings Biological Society," Washington, Vol. 19, p. 136, 1906. Since then it has been described by Pavos, in "Sanidad y Beneficiencia." Nothing is known of its habits, so there is scope for original research. It is not known to carry malaria. It occurs in Guatemala, Mexico, Cuba, and Jamaica.

2. *Anopheles crucians*, Wiedemann, 1828. I have now no doubt that this is identical with the mosquito found by Moseley at Port Antonio, and described under the name *Anopheles punctipennis*: Say, in "Mosquitoes or Culcidæ of Jamaica." I have seen Dr. Moseley's specimen, and they are alike. In Giles's work, "Gnats and Mosquitoes," the *A. punctipennis*, Say, and the *A. crucians*, Wied., are regarded as synonymous. The mosquito has been well described by Professor Smith, of New Jersey. It has a southerly and easterly distribution in the United States ranging as far north as Long Island. It is called the "day-light anopheles" in America, and

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* No. 8 in Appendix VI.

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is a great nuisance to travellers on the Mississippi. It also occurs in Cuba. Specimens have since been found in Jamaica at Montego Bay, Black River, and Annotto Bay. This mosquito has been proved to carry malaria. Mr. Austen, on receipt of the specimens, wrote : " I am particularly glad to have these mosquitoes, since neither species was previously represented in our collection."

It is interesting to note that a small limnobi occurs in Jamaica which is extremely like the *anopheles albimanus* in appearance. The resting position is practically identical. It is a harmless, non-biting diptera.

Since the anti-malarial crusade instituted by the Malaria Commission there has been a marked improvement in conditions generally over the Island. The following return will show the improvement in the Spanish Town District.

Admissions of natives suffering from malarial fever to the Spanish Town Hospital, with rainfall for same period.

——	1911–12.		1912–13.		1913–14.	
	Cases.	Rainfall.	Cases.	Rainfall.	Cases.	Rainfall.
April	14	1·11	15	0·67	7	6·04
May	6	8·27	16	0·10	11	6·53
June	28	0·38	19	0·1	21	0·74
July	41	0·18	21	0·70	13	1·07
August	23	1·66	19	2·47		
September	15	0·70	14	2·79		
October	13	2·65	26	2·65		
November	27	2·38	38	14·39		
December	35	1·31	26	0·70		
January	31	2·83	23	0·25		
February	15	0·87	15	0·14		
March	15	1·30	9	0·55		

Not only are the cases less from month to month, but the type of fever is much milder. Very few quartans are now seen, and the malignant tertian is not so common. There is marked improvement in the Caymanas District, where the owners have screened quarters with wire gauze, and issued large quantities of quinine as a prophylactic measure.

There is much, however, to be done in educating the people how to deal with latent malaria.

During the year 1879, at the Public Hospital, Kingston, Sir D. P. Ross and my father, Dr. James Neish, carried out a series of investigations with cinchona alkaloids and cinchona febrifuge in malarial fevers. The preparations were obtained from India, and the conclusions arrived at were greatly in favour of the alkaloids compared with sulphate of quinine, at that time 20s. per ounce.

Later, in 1889, while District Medical Officer at Old Harbour, I treated a series of cases with " alkaloids " which I obtained from cinchona bark grown at the cinchona plantations in Jamaica. The results satisfied me that the cinchona alkaloids are more efficacious in the treatment of malarial fevers than quinine salts, and this is also the recent opinion of Waters, *vide* Tropical Diseases Bulletin, Vol. 1, page 650.

It is well for Colonies that propose medical prophylaxis to keep this in mind as " amorphous alkaloids " is stated to be four rupees a pound, a great consideration where large quantities of the drug are required for free distribution.

Ankylostomiasis.

Not only are East Indian immigrants and the native labourer badly infected, but recent investigations demonstrate that the police of St. Catherine are infected with hookworm. In this connection I may mention that I am satisfied that many of the cases of " fever " admitted to hospital are not caused by the malarial parasite. Castellani has described the febrile condition occurring in hookworm disease, and it should never be overlooked.

I advocate the general use of salt solution as a disinfectant for latrines and barrack compounds. I observed in my laboratory that ova and small ankylostomes were destroyed by normal saline solution. This also accounts for the absence of hookworm disease on two estates in Portland, where the labourers live in barracks built on the seashore.

It is quite practicable in any part of Jamaica to make a solution from " rock salt " to be sprinkled periodically over the compounds and around barracks with a watering pot.

I have, &c.,
W. D. Neish.

The Hon. Senior Medical Officer,
Kingston.

Enclosure 2 in No. 9.

From Dr. T. M. Bartlett, District Medical Officer, Morant Bay, to the Superintending Medical Officer.

Sir, Morant Bay, 27th August, 1913.

With reference to the report of the Advisory Committee for the Tropical Diseases Research Fund, which you have referred to me for remarks, I notice that in Captain Potter's report on vomiting sickness (p. 177), he states : " It is significant that one of the popular names for vomiting sickness is ' black vomit.' " This is a point in his argument towards the conclusion that the so-called vomiting sickness is yellow fever. During the course of last year I was called in consultation to see a child of about three years of age who had been suffering for two days from symptoms of malarial fever (the parasite of simple tertian were present in the blood); on the third day convulsion set in, the temperature going up to 106°; hypodermic injections of quinine and the cold pack proved unavailing. Shortly before death a quantity of black material was vomited, and the practitioner in attendance suspected yellow fever. A microscopic examination of the spinal fluid showed the presence of diplococci, and a diagnosis of epidemic cerebro-spinal meningitis was made. Subsequently—three or four months later—another member of the same family, aged 12 months, living in the same house, was attacked with similar symptoms—fever convulsions and black vomit—ending in death. Here, again, diplococci were found in the spinal fluid, and cultures were forwarded to Dr. Scott, who pronounced the organism to be the diplococcus of Weechselbaum.

I may add that no epidemic of cerebro-spinal meningitis has occurred in my district during my experience of the past twelve years.

I have, &c.,
T. M. Bartlett,
District Medical Officer.

Superintending Medical Officer,
Kingston.

No. 10.

JAMAICA.

The GOVERNOR to the SECRETARY OF STATE.

(Received 6 November, 1913.)

Sir, King's House, Jamaica, 16 October, 1913.

In continuation of my despatch dated the 15th April, 1913,* I have the honour to transmit, for the information of the Committee of the Tropical Diseases Research

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* No. 8 in Appendix VI.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Fund, the report of the Government Bacteriologist of this Colony on the work carried out by him during the half-year from 1st April to 30th September, 1913.

I have, &c.,
W. H. MANNING,
Governor.

Enclosure in No. 10.

Six-Monthly Report on the Work of the Government Bacteriologist, March to September, 1913.

The Pathological Laboratory,
Kingston, Jamaica, October 1st, 1913.

Sir,

I have the honour to forward herewith my report on the work done at the Pathological Laboratory during the six months ending September, 1913, for the information of the Right Honourable the Secretary of State for the Colonies.

The staff of the laboratory consists, as before, of myself as Government Bacteriologist, one trained laboratory assistant, and a boy as cleaner. The assistant, Mr. S. M. Dailey, has been of very great help to me in relieving me of much of the routine work, such as the preparation of media, preparation of tissues and specimens for examination, and so forth.

The routine work is now very heavy and unremitting; during each of the two previous periods reported upon (March-September, 1912, and September, 1912-March, 1913) over 3,000 specimens were dealt with, and this total has been exceeded during the half-year now under review. The fact has been recognised that one man cannot continuously deal with so great an amount of work, and early in the year a vote was passed in the Legislative Council for an Assistant Bacteriologist. The appointment has not yet been made, but doubtless a suitable man will soon be found.

Appended to this report is a table (Table IV.) showing month by month the numbers of specimens of various kinds received and examined by me at the laboratory.

Many of them, of course, being such as are common in routine work of all pathological laboratories, do not call for special mention, but the following subjects merit more detailed description :—

(1) Enteric fever.
(2) Helminthiasis (particularly ankylostomiasis).
(3) Dysentery.

I. *Enteric Fever.*

There have been 561 specimens of blood sent up for Widal's reaction of agglutination during the six months. Of these, 353 gave a positive reaction. As before, there has been a considerable proportion of cases in which agglutination of *Bacillus paratyphosus A* occurred either in a higher degree of dilution than that which agglutinated *Bacillus typhosus*, or to the exclusion of the latter. This question was dealt with fully in my September report last year, and the value of this reaction as a prognostic agent was then gone into. This has been amplified into the form of a paper, which, as the subject was one of interest and importance to medical men in general practice, was sent to the "Practitioner" Medical Journal, and will be published there shortly.

Of the 353 positive reactions given, 219 sera agglutinated *B. typhosus* only, 98 *B. paratyphosus* only, and 36 were cases of dual infection. Ordinary "group agglutinin" reactions (and up to a 1 : 30 dilution) were disregarded. The dual infection was inferred where agglutination of both bacilli occurred in high dilutions, and subsequent testing was carried out by complement fixation or by Castellani's method.

Amongst the total number giving agglutination, four showed what I described in my third report as the reversed reaction. It was there mentioned that nearly all the cases occurred in children, and that the symptoms were usually anomalous. So in one of these four, a child of 11 months, the attack started with obstinate vomiting and fever, and it was the continuance of the latter that led to the testing of the blood.

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REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Table I., appended, shows the districts from which the specimens have been sent up, and the results of the examinations in each case.

Routine examination of the blood of men at the Spanish Town Prison prior to their being employed in the kitchens, or taking any part in the handling or distribution of food, resulted in the finding of a carrier. This man, so far as his history could be obtained, stated that not only had he not had any previous attack, but, to the best of his recollection, he had never suffered from any fever of a prolonged character at all. There must always be a certain element of doubt as to the truth of such a history in the case of a native, especially where, as in the present instance, there is no possibility of confirmation of his statements, but if it be true, this man would be an example of those rare instances of a person excreting the *B. typhosus* without having passed through an attack of typhoid fever, that is, there may be a condition of cholecystitis present due primarily to the *B. typhosus*, such as has been recorded by Guarnieri, Pratt, and Blumenthal.

Further investigations, undertaken in order to determine whether the excretion of the bacilli is continuous or intermittent, have revealed the fact that the latter is the case.

I think it right to emphasise once again the fact that cases diagnosed as "paratyphoid fever" (owing to agglutination of *B. paratyphosus* in high dilution of the serum) are by no means instances of the comparatively mild affection often seen at home. Many of them are very severe, and not infrequently fatal, and clinically a large proportion of them cannot be distinguished from typhoid fever. I regret that it is not possible for me to give the actual figures and statistics of cases clinically indistinguishable from typhoid fever, nor of the mortality rate, because specimens are sent to this laboratory from all parts of the island, and though in some instances the history is given either that the patient appears, clinically, to be suffering from enteric fever, or that the patient shows a continued fever for which no cause can be found, nevertheless, in many no history is given at all beyond the remark that the patient "has had fever for so many days, not affected by the administration of quinine." Again, except in the case of patients at the Kingston General Hospital, to which the laboratory is attached, after notifying the medical man who has forwarded the specimen as to the result of the agglutination test, I naturally hear nothing further as to the termination of the illness, whether in the patient's recovery or death. These points could be supplied by the various medical officers of health, and would afford valuable information as to the prevalence and gravity of paratyphoid fever here.

It will be seen that the hospital cases constitute less than one-third of the total sent up, hence, any calculation based upon so small a proportion would be erroneous and misleading.

Seeing, then, that so large a percentage of these cases give a marked agglutination of *B. paratyphosus*, sometimes with, but often without, a similar action with *B. typhosus*, and that such are equally capable of transmitting the disease, and also that the affection is often quite as severe and serious as an attack of true typhoid fever, I suggested in my September report last year that both conditions should be made notifiable under the term "enteric fever." This view of the question was submitted to the Superintending Medical Officer, who at once agreed to the proposal, and he has had this change, or rather addition, made in the notification law, so that such are now reported as "enteric fever," and where bacterial examination has been carried out, the words "*B. typhosus*" or "*B. paratyphosus* infection," as the case may be, is added to the notification certificate. This is not a mere academical distinction, but a point which should be, and, considering the short time the rule has been in force, has been, of help to medical officers of health in tracing cases and the sequence of cases of enteric fever. It was not at all uncommon previously for the medical attendant to take the view that since the case had been diagnosed as one of paratyphosus infection there was no need to notify it "as it was not a case of *true* typhoid fever," and, in consequence, there was no necessity to worry the patient or his friends with disinfection procedures. In other words, as a consequence of the case going thus unreported, no precautions (or very slight and ineffectual ones) were taken, further cases arose, and there were great, if not insuperable, difficulties in trying to trace out the source of the outbreak or sequence of cases.

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It is impossible to say definitely as yet from the laboratory results whether enteric fever is increasing, remaining stationary, or decreasing in the island. It is true that there have been rather more positive reactions in proportion to the number of specimens sent up (219 *typhosus*, 98 *paratyphosus*, and 36 mixed, giving a total of 353 and a percentage on the specimens examined of 62·92, as compared with a total of 323 and a percentage of 58·4 during the corresponding period last year), but the value of the examinations is becoming more widely known, and, in many instances, specimens are sent up from patients who in former times (that is, before the instituting of the laboratory) would have been certified as suffering from malarial fever, simple continued fever, or " fever undefined " (under the last-named many deaths were recorded), and undoubtedly some of these were enteric fever cases.

Before leaving the subject of typhoid and paratyphoid fevers, it will be of interest to say a few words on a peculiar febrile condition which breaks out practically every year at a public institution in the parish of St. Andrew. In the words of Dr. Turton, the District Medical Officer of the district:—

> " Beginning about July or August in each year, and going on to the end of the year, more or less, cases of continued fever of a particular type have cropped up. There may have been many cases in any one year—twenty or thirty—or there may have been but one or two, but no year has passed without examples of this form occurring. This is the distinct recollection of the Superintendent, going back over thirty years—of the senior nurse over twenty years—and it is within my own knowledge since 1899, thirteen years.
>
> " It was known before and during my time as the 'bad fever,' the name given by the native population to forms of typhoid fever.
>
> " The clinical picture is that of a 21 days' fever, with arch of temperature usually reaching 104°; a tongue slightly furred except at the tip, which is narrow, pointed, and red—so far like a typical typhoid, but there the resemblance ceases. Diarrhœa is unusual; nervous symptoms very unusual. A boy will pass through his attack, as a rule, with the utmost serenity of mind, and can only be prevented from eating anything he can get hold of, and getting out of bed, by the discipline of the hospital. So that, if these cases are typhoid, they are of a very mild type indeed. The mortality is very small."

Sera from several of the patients exhibiting the above symptoms have been examined on more than one occasion by Widal's test with varying results. Some of them gave partial reactions with both *B. typhosus* and *B. paratyphosus*, that is, the bacilli lost their motility, and there may have been a tendency to agglutination shown, small clumps of three or four bacilli being seen, but only in low dilution; some gave definite agglutination of one or other bacillus in low dilution, and some gave a well-marked positive reaction.

The excreta, both fæces and urine, were examined, on more than one occasion, of twelve cases who had passed through a similar attack, in order to find whether there was a " carrier " spreading the disease (if typhoid or paratyphoid), but all with negative results.

I have not yet had an opportunity of taking blood from any of the patients in an early stage with a view to obtaining a culture, but the data so far obtained make one rather incline to the idea that the organism at work in this condition is one of the coli-typhoid group, but not either the true Eberth's bacillus nor the *paratyphosus A*, and that in some of the cases at least the positive results in low dilution were of the nature of group agglutination action, the true causative organism not having as yet been isolated and determined.

II. *Ankylostomiasis.*

During the year ending March, 1913, over 800 specimens of excreta were examined from various districts of the island, and 78·2 per cent. of these were found to contain ova of hookworm. In my annual report to the Medical Department for that period it is stated:—" The condition (that is, helminth infection) is much more common than has been generally believed. . . . . In some districts over 90 per cent. of the specimens examined revealed their presence, and in many instances in large numbers."

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The question is an important one in this island, since it leads to a considerable degree of incapacitation among the estate labourers. With the introduction of a place of detention for treating all immigrating coolies, if found to harbour this parasite, whence they can be sent to various parts of the island after being cleared of them, the amount of infection must indubitably be lessened, although the soil around the habitations of the earlier arrivals, who have not been so treated, must be highly infected.

More detailed investigations have been undertaken during the six months, March to September, to estimate more accurately the extent to which this worm has affected estate labourers and others in Jamaica. This has been a laborious and unsavoury undertaking, but has afforded valuable information, and, far from modifying the above statements, the results have shown that the prevalence of infection was, if anything, under-estimated.

The appended tables have been drawn up showing the numbers of specimens sent up from various parts of the island, and the number in which the ankylostome was found to be present, either alone or in combination with other worms. These tables are almost self-explanatory, and call for but little amplification. From these it will be seen that over 1,100 specimens have been examined, and of these, 884, or 76·07 per cent., were found to contain the ova of hookworm. (Tables II. and III.)

These were not, in the majority of instances, selected cases, by which I mean cases showing marked clinical symptoms indicative of helminthiasis. District medical officers were asked to send up a certain number of specimens weekly, and the matter was left to the assistants (non-medical men), who would select the subjects mostly at random.

The most frequent concomitants of the hookworm were the *Trichuris* and the *Ascaris*. The table shows the number in which all three were found, as also the number in which each of them existed separately.

The method of examination on arrival of the specimen at the laboratory has been as follows:—A portion of the fæces was well shaken up with water in a specimen tube (unless the stool was fluid), and the resultant emulsion was then centrifugalised and slides of the deposit put up, a cover-glass applied and the specimen examined. If found negative a second and a third slide were examined. It was not possible to look at more than three, for on some days as many as 50 or even more excreta have had to be examined in addition to other work, and it would probably be safe to say that, had the calcium chloride method been employed, a slightly higher percentage of positive findings would have resulted.

Helminthiasis, existing to the extent of over 90 per cent. (see Table III.), undoubtedly accounts, to a considerable degree, for what has been regarded as the natural dulness, indolence, and "ergophobia" of the native. Many were sent from the estates for treatment with indefinite symptoms of fatigue on mild exertion, slight fever, want of concentration and general hebetude. At first the blood used to be sent for examination, and the existence of eosinophilia gave an indication of the possible cause; examination of the excreta in the majority of cases revealed an abundant helminth infection, and proper treatment resulted in the cure of many and the improvement of most, though, of course, on returning to work on the estates with an infected soil, recurrence would soon take place.

The disease is not, however, confined to estate labourers. For example, many constables have reported sick with the same indefinite symptoms, and were found to be harbouring the hookworm.

Eradication is by no means always the easy matter that we are led to believe. Many clear up rapidly on the 90 or even 60 grain treatment with thymol—a gentle aperient the day previously, no solid food afterwards; then 20 grains (or 30 grains) of thymol at 7 a.m., 8 a.m., and 9 a.m., followed at 1 p.m. by an aperient. Milk is not a good form of nutriment, as it forms too bulky a stool, and so tends to prevent the action of the drug—but others prove resistant to this after two, three, and even five courses. Possibly the thymol has been given in small and inadequate doses previously, and the subsequent effect thereby diminished, but this is pure surmise.

Trichocephalus is also very prevalent, and ought not, in my opinion, to be regarded as a harmless inhabitant of the intestine, for some cases exhibiting the same symptoms are not found to be harbouring the hookworm, but the whipworm is found in large numbers.

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Into the question of any connection there may be between this parasite and other intestinal affections, such as appendicitis, enteric fever, &c., I will not enter, as no special work has been undertaken on this subject at this laboratory. I hope to go into this question later, as it is both an interesting and important one, and may constitute a factor in the high prevalence of enteric fever in Jamaica.

Other helminths found occasionally were: *Strongyloides intestinalis*, *Oxyuris vermicularis*, *Tœnia solium*. The first of these is the one most often present of the three, but even this is very rare here, not nearly so frequent as appears to be the case in the Canal Zone. In one case *Hymenolepis nana* was found.

A few words more with reference to the *Trichocephalus*. Thymol is the drug most usually recommended for this as for ankylostome infection, but it certainly (in Jamaica at all events) cannot be regarded as satisfactory in its action on the former parasite. In many instances in which ankylostome and *Trichocephalus* were found to be present, it was noticed that, on subsequent examinations being made after thymol treatment, although the former had been eliminated, the latter were still present in large numbers, judging by the ova seen. Other drugs tried here appear to be equally unsuccessful, and it would be well to make further attempts with the Latex d'Higueron (*Ficus glabrata*), which has been so highly lauded by Berrio for infection by this worm in Columbia (Rev. de Méd. et d'Hyg. Trop.); he states that he has found it a most effectual vermicide in the case of *Ascaris* also, which has been seen in 33·2 per cent. of the specimens examined by me.

III. *Dysentery.*

During the past six months there has been considerably more dysentery than usual in the island. The disease has not been limited to any particular district, and has not been actually epidemic. Such outbreaks (or perhaps the condition of things would be more correctly described as an increase in the number of cases) are said to arise in Jamaica after a disaster, such as a hurricane. A severe hurricane visited the island at the end of last year, and whether the spread may be ascribed to the consequent exposure, bad hygienic conditions, closer contact, and so forth, I am unable to say. Many examinations of the water supplies of the districts affected have been undertaken, but there has been no indication that the spread of the disease has been due to the water, but more to personal contact, uncleanliness, and flies.

The affection has been of several varieties: amœbic, bacillary, lamblial, and balantidium forms have occurred, the former two preponderating, and the first more often than the second. Several cases reported as dysentery, merely because of the frequent actions of the bowels, were probably only cases of colitis of a non-specific nature, due to irritating ingesta, such as unripe fruit.

In three instances *Balantidium coli* was found in large numbers in the fæces; in five the *Lamblia intestinalis*, while in four *Trichomonas intestinalis* was present. All except one of each of the latter occurred in children.

The opinion was formerly held that the amœbic form of dysentery was not seen in Jamaica. The main reason for this statement seems to be the unsatisfactory one that liver abscess is very rare, and that this would not be so if the variety of dysentery present were amœbic. This is a most fallacious argument; it would be quite as legitimate to argue that enteric fever was uncommon because cases of perforation are seldom met with. In reply to this, two points may be brought forward:—

Firstly, true dysentery of all kinds exists to a smaller extent than one would think, judging by the returns. Where the diagnosis is made (as it is in the vast majority of instances) from clinical conditions only, many cases of ordinary acute colitis of dietetic origin are returned as dysentery. Thus, of 182 specimens sent up from patients who had been reported as suffering from dysentery in 99 (54·39 per cent.), neither the amœba nor the bacilli of dysentery could be found. Possibly, nay probably, in some cases one or other was present but escaped detection, although most careful examination and cultural attempts were made for isolation of the bacilli; nevertheless, so far as one can form an opinion, nearly half the cases reported as dysentery are not true dysentery at all.

Secondly, liver abscess does occur, and is probably not so uncommon as practitioners in this island have believed. In support of this statement, two cases within the last six weeks have been brought to my notice; both of them had been sent to

the hospital with a definite diagnosis of right-sided empyema, but both turned out to be hepatic abscess. There is no reason to suppose that such cases are limited to Kingston, and undoubtedly in country districts, where only minor operations are performed, such would be diagnosed as empyemata, pus would be evacuated through an intercostal space, and if the patient recovered nothing further would be thought about it, whereas, if death occurred, the probabilities are that no autopsy would be held as the diagnosis had already been made.

In connection with the subject of hepatic abscess, the following two cases are worthy of mention in detail. The notes of them have been kindly given to me by Dr. C. A. H. Thomson, who had charge of the patients while in hospital :—

(1) R. McG., male, aged 24 years; admitted to hospital 18th July, 1913. He had been sent up diagnosed as suffering from right-sided empyema by the medical man who had been attending him during the previous nine days. On admission his temperature was 100·6° F., and pulse, 128; respiration, 36. He gave history of having lived for some years in Costa Rica, but stated that he "had not suffered from dysentery." For two years past he had had attacks of "fever" and pain in the right side of the chest, with, at times, expectoration of thick blood-stained mucus.

The note to percussion on the right side at the base was impaired, but dulness is said not to have been very marked. The liver was tender on pressure, but not much enlarged.

The sputum was sent up to the laboratory to be examined for tubercle bacilli, but with negative results. On July 19th a fresh specimen was asked for, owing to the peculiar "liver-pus" appearance of the previous specimen. Amœbæ were seen in the unstained specimen, and proved to be *A. histolytica* on further investigation. Expectoration was very profuse. Temperature on 19th, 100° F. in the morning, 103° F. in the evening.

Emetine hydrochloride, gr. ½, was given hypodermically on that day and each day subsequently, till the 23rd, when the dose was reduced to one-third of a grain, as the patient was markedly improving. Five days later the following note was made :—Temperature has not been above 98° F. for two days; cough, very slight; expectoration has ceased; there is still some tenderness over the liver.

The emetine was stopped on the next day, improvement was steadily maintained, and the patient finally left the hospital "feeling quite well" on September 3rd, having gained 16 lbs. in weight during his stay. There were no physical signs of any residual chest trouble.

The only case reported, so far as I am aware, analogous to this, is one by Sewell, in the Journal of the Royal Army Medical Corps for June, 1913.

(2) H. W., male, aged 45 years; admitted to hospital on August 23rd, 1913, complaining of tenderness over the liver, with cough and "reddish brown" expectoration. He gave a history of an attack of dysentery in Costa Rica three months previously.

There was dulness over the right lung as high as the fourth rib in front and third rib behind, with deficient breath sounds, and the liver was enlarged and tender. The expectoration was fairly abundant, no tubercle bacilli were seen, but amœbæ were looked for on account of the lesson taught by the case just reported, and of the history given of an attack of dysentery. *A. histolytica* was found, and emetine was at once commenced. Half a grain was given daily by hypodermic injection, and on the fifth day afterwards is the note :—Cough less troublesome, expectoration less. Temperature, 99° F. in the morning, 101° at night. The patient continued to improve, and a week later (September 8th) it is stated : "Emetine stopped on September 5th. Temperature, normal; cough occurs only at night; expectoration very much diminished; patient is feeling better and gaining weight." He is still in hospital.

A few points worthy of special mention remain :—

(1) Although elephantiasis is not uncommonly met with, it is never seen, so far as I am aware, in patients who have always lived in Jamaica. Also, I have never yet seen a case of filariasis in a Jamaican unless he has been abroad. This is of interest in connection with cases of deep suppuration in the muscular tissues, such as have been reported in British Guiana by Wise and Minnett, and elsewhere abroad, and in contrast with what I have reported formerly in cases where the pus (or serous fluid) is associated with the bacillus previously described by me and named *B. serofaciens.* Two more such cases have occurred with histories very

similar to those previously reported, but careful search has failed to discover any filariæ.

In two other patients the filaria has been found in blood taken at night (1 a.m), but one of these had lately returned from Barbadoes, and the other was a Haytian refugee.

(2) Three cases of blackwater fever have come under my notice. In one of these subtertian malaria parasites were found in considerable numbers during the first day, but not subsequently. Smears were examined daily from all three, but I am sorry to say that in none of them could I discover any chlamydozoa or cell-inclusions such as have been noted by Sir William Leishman and others.

(3) *Piroplasma bigeminum* has been found on several occasions in the blood of cattle suffering from texan fever. In one case nearly 50 per cent. of the red corpuscles showed the presence of the parasite, the smears being made shortly before the death of the animal. Some of these slides were sent home to the School of Tropical Medicine.

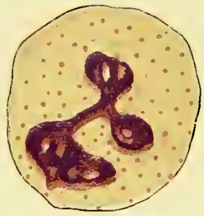
(4) There have been two cases giving the clinical blood-picture of pernicious anæmia. One is still in hospital, the other died, and at the autopsy a small malignant ulcer of the stomach was discovered on the upper and posterior surface near the pylorus. The gastric symptoms had been slight, and, except for some pain, not of great severity, and progressive emaciation; there were no symptoms pointing to carcinoma.

One case of *Myelogenous leukæmia* has occurred in which the leucocytes were present to the number of 440,000 per cubic millimetre, and of these, 118,800, or 27 per cent., were *myelocytes*, and 1 per cent. *eosinophile myelocytes*.

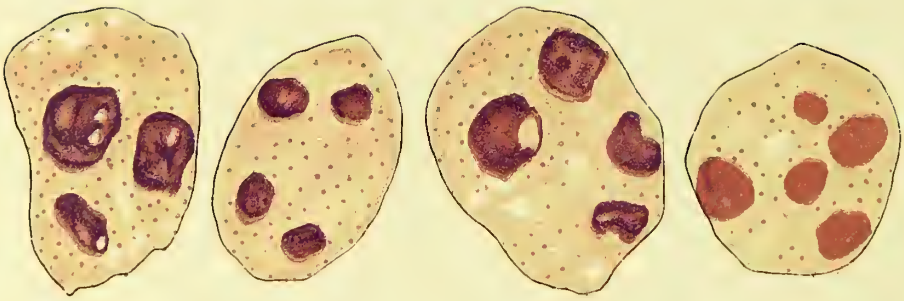
(5) Lastly, in the blood of a patient giving the following history some peculiar bodies were observed :—

H. L. E., male, aged 46 years. In 1899, at the age of 32, he contracted a chancre, followed by a bubo, for which he was treated. About one month later, while still under treatment, he began to suffer from what he calls "rheumatism" in all his joints, but there was no swelling, and he states that he had no fever. There is no history obtainable of any other secondary manifestations (if the affection be regarded as syphilitic). In 1903 he had several attacks which he describes as malarial fever, but the temperature never rose above 102°, and rarely higher than 101° F. He is quite sure on this point. He is an intelligent man, and has for years been working with the hospital and sanitary staff at Panama and Colon. During the last ten years he has had frequent attacks of slight fever. The following is his description of these attacks :—They begin with yawning and chilly feelings, and the temperature may go up to 101° F. (during the last fourteen months never higher); he has no headache. Sometimes he goes to lie down, at other times he takes a walk and perspires, and the temperature falls to 99° F., and he feels better. A similar attack comes on again after an interval of, in some instances, twenty-four hours, in others not for three days or even longer. The total duration of an attack is most often twelve hours or thereabouts, but sometimes only four hours, while on other occasions the temperature does not fall to normal for several days. He has had quinine in various doses and administered in various ways, but it does not appear to affect either the attacks or the frequency of their return. They come on at any time of the day, sometimes in the morning, sometimes at noon, sometimes about 3 p.m., rarely at night. He once went as long as three months without an attack, and he notices that if he removes either from the plains to the hills or *vice versâ* the attacks are in abeyance for two weeks or so. His appetite keeps good, he sleeps well, and has not lost weight. Many of these symptoms are, of course, strongly suggestive of malarial infection, but at Panama, if anywhere, malaria is thoroughly and efficiently dealt with, and he has been on their hospital and sanitary staff for years, and quinine seems not to have any effect. When I first examined his blood his temperature was 100·6° F. He did not look ill. He had had no treatment of any sort for the previous four days. I searched for malarial parasites, but could not find any, nor any pigmented mononuclears, but several of the bodies shortly to be described. On finding them I wrote to the medical man who had sent the patient up, asking him to persuade the man to come again to me. He came four days later and then had no rise of temperature. I prepared a large number of slides with blood smears and examined them all very thoroughly, but was not able to detect a single one of the bodies in any of them. He was leaving Jamaica soon, so I requested him

Erythrocyte.



Polymorphonuclear leucocyte



Forms of "bodies" present in blood of patient H. L. E. during fever.

(All drawn with Abbé apparatus. Zeiss Oc. 12, Obj. 2 mm., oil imm. apochromatic, Tubus 160.)

37711 W B & L. 11.13.

Appendix VI.

to get the medical man under whose treatment he placed himself to send me some more smears taken while the temperature was elevated. He did so, and two smears were sent by his doctor to me. One was very thick and useless, the other shows the same bodies shortly to be described. I wrote for more, but the patient had not been to consult the medical man again; the latter did not know his address, and I fear he has again changed his place of abode.

The "bodies" are round or oval, varying from 9 to 16 microns in length and from 13 to 9 in breadth; ten separate measurements gave an average of 12 by 11 microns. They show a fine pink granulation when stained by Leishman's or Giemsa's stain, very like the fine granules of a polymorphonuclear leucocyte, and within the body are, as a rule, four definitely-rounded smaller bodies having a diameter varying between 1 and 2 microns, which, in most instances, stain uniformly dark, but occasionally show a still more deeply-staining particle inside. In some there are only three such instead of the usual four. They show no reticular structure like the nucleus of a leucocyte, and the smaller contained bodies are quite separate one from the other, and show no connecting thread as that between the constituents of the nucleus of a polymorphonuclear leucocyte, as in the rough sketch herewith [*see illustration*]:—

Whether these bodies are in any way causative, or have any real connection with the patient's condition I cannot say on such insufficient evidence, but it is strange that they should have been present on two occasions when the blood was taken during a period of elevation of temperature, and absent from any of the numerous specimens submitted to examination taken when the temperature had dropped to normal.

I hope to have an opportunity of showing the slides to Sir W. B. Leishman and others who may be able to throw some light on the subject.

I have, &c.,
H. H. Scott, M.D., London,
Government Bacteriologist.

The Honourable
the Superintending Medical Officer.

Table I.

Results of Widal's Agglutination Tests. April to September, 1913.

District.	No. sent.	No. Agglut. Typh.	No. Agglut. Parat.	Double Infection.
Annotto Bay	25	18	5	—
Bethel Town	9	6	—	1
Buff Bay	20	8	5	1
Chapelton	6	1	1	1
Christiana	2	1	1	—
Falmouth	2	1	1	—
Gayle	3	2	—	1
Grange Hill	4	3	1	—
Kingston Public Hospital	137	72	11	8
Kingston (not hospital)	58	15	2	4
Linstead	11	7	—	—
Lionel Town	6	3	1	—
Malvern	2	1	1	—
Manchioneal	2	2	—	—
Mandeville	23	7	5	5
Montego Bay	61	14	17	4
Morant Bay	6	2	1	—
Newport	7	3	1	—
Plantain Garden River	34	8	13	1
Port Antonio	37	7	10	2
Port Maria	18	6	3	2
Richmond	6	—	3	1
St. Ann's Bay	26	10	6	2
Spanish Town	47	18	8	3
Others	9	4	2	—
Totals	561	219	98	36

H. H. S.

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REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Table II.

Details of Helminthiasis in the various Districts. April to September, 1913.

District.	No. sent.	Negative.	Ankyl. only.	Ascaris only.	Tricho. only.	All three.	Ankyl. and Tricho.	Ankyl. and Ascaris.	Ankyl. and others.	Ascaris and Tricho.	Others alone.
Alexandria	21	3	2	—	2	8	3	1	1	1	—
Annotto Bay	29	2	13	—	2	8	1	—	1	2	—
Black River	36	10	11	2	3	4	1	2	—	3	—
Buff Bay	164	9	57	5	5	47	30	7	1	3	—
Chapelton	71	6	16	5	3	17	13	9	—	1	1
Falmouth	28	3	4	—	5	4	6	4	—	2	—
Hospital and Kingston...	76	18	31	1	8	7	10	1	—	—	—
Linstead	9	1	4	—	—	2	1	1	—	—	—
Lionel Town	140	18	44	12	25	12	15	10	—	3	1
Lucea	22	—	15	—	—	1	—	5	—	1	—
Mandeville	6	—	1	1	—	1	3	—	—	—	—
May Pen Poor-House ...	21	2	10	1	1	3	4	—	—	—	—
Montego Bay	44	6	22	1	—	9	5	1	—	—	—
Plantain Garden River ..	172	8	36	19	18	36	41	12	—	2	—
Port Maria	75	2	28	—	—	20	13	7	4	—	1
Sav-la-Mar Poor-House	3	1	—	—	—	1	1	—	—	—	—
Spanish Town	197	19	73	3	14	36	30	18	1	2	1
St. Ann's Bay	27	4	6	—	2	4	4	5	—	2	—
St. Mary's Poor-House...	21	1	7	—	1	6	1	5	—	—	—
Totals	1,162	113	380	50	89	226	182	88	8	22	4
Percentages on positive results.	No. positive, 1,049	—	36·22	4·76	8·48	21·54	17·35	8·38	0·76	2·09	0·38

H. H. S.

Table III.

Showing the percentage of Helminth infection in general, and of Ankylostomiasis in particular, in Districts from which over 100 Specimens have been sent. April to September, 1913.

—	Helminthiasis.	Ankyl. only.	Ankyl. alone and in combination.
Buff Bay	94·51	36·77	91·61
Lionel Town	87·14	36·06	66·39
Plantain Garden River ...	95·34	21·95	76·21
Spanish Town	90·35	41·01	88·76
Spanish Town Hospital ...	92·72	37·25	91·17
Spanish Town Prison ...	87·35	46·05	88·15
Whole Island	90·27	36·22	84·27

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Table IV.

Showing the number of Specimens examined month by month at the Laboratory. April to September, 1913.

—	April.	May.	June.	July.	August.	September.	Total.
Enteric	68	85	106	85	117	100	561
Blood Smears	106	89	89	81	84	69	518
Fæces, Hookworm	76	186	365	250	156	129	1,162
Fæces, Amœba, Bacilli, &c.	25	30	42	16	54	36	203
Urine	21	17	16	10	17	24	105
Pus Smears	10	15	12	19	31	18	105
Sputum	23	12	20	21	28	15	119
Tissues	48	44	3	17	11	21	144
Waters	10	11	19	8	29	9	86
Miscellaneous	66	36	22	30	35	58	247
Total	453	525	694	537	562	479	3,250

H. H. S.

No. 11.

LEEWARD ISLANDS.

The GOVERNOR to the SECRETARY OF STATE.

(Received 14 October, 1913.)

Sir, Government House, 20th September, 1913.

I have the honour to transmit to you a copy of a despatch from the Administrator of St. Kitts-Nevis, covering reports by the Medical Officers in charge of the Pogson Hospital on the treatment of yaws by "Salvarsan."

2. The effects of this marvellous preparation lead us to hope that a disease which, for generations, has been a veritable scourge to the coloured inhabitants of the West Indies will soon be practically eliminated from these Islands. Dr. Foreman's experiments with "Salvarsan" in cases of syphilis and of filaria are very interesting, and will doubtless be followed up.

3. The results obtained in St. Kitts and Nevis now justify us in vigorously dealing with "yaws" in Montserrat, Antigua, and Dominica. The disease is, fortunately, not extremely rife in those islands, but the advisability of stamping out every focus from which infection might be spread admits of no contention.

I have, &c.,

H. HESKETH BELL,

Governor.

Enclosure in No. 11.

Government House, St. Kitts, West Indies,

Sir, 9th September, 1913.

With reference to Your Excellency's despatch of the 19th August, I have the honour to transmit

(1) a report by Dr. Foreman, Medical Officer of No. 4 District, and Medical Officer in charge of the Pogson Hospital, on the treatment in that institution with salvarsan of patients suffering from yaws, during the period 14th March, when the yaws ward was opened, to the end of May, when he went on leave.

(2) a report by Dr. W. B. Cunningham, who is acting as Dr. Foreman's *locum tenens*, on the treatment of yaws cases since he assumed charge of the hospital at the beginning of June to the present time.

2. It should be explained that I purposely delayed sending on Dr. Foreman's report when he submitted it on 2nd June, as it covered so short a period, and had

proposed to get Dr. Cunningham's report at the end of September, so that the two reports would have covered a period of six months.

3. Your Excellency and the Secretary of State will, I am sure, be gratified to learn of the apparently complete success with which salvarsan is being used in the yaws ward at the Pogson Hospital. There is now a ward at the Alexandra Hospital, Nevis, but it only became available for use at the end of July, and it is somewhat early to transmit a report on the treatment of cases there. I shall hope to do so, however, at the close of the year.

I have, &c.,
T. LAURENCE ROXBURGH,
Administrator.

His Excellency
Sir Henry Hesketh Bell, K.C.M.G.,
Governor of the Leeward Islands,
Antigua.

SIR, Sandy Point, 2nd June, 1913.

BEFORE going on leave, I have the honour to submit the good results obtained from a series of 27 cases of yaws treated with salvarsan, at the yaws ward of Sandy Point, opened on the 14th March this year. Only six beds are available at a time.

1. At first there was great reluctance on the part of parents in making up their minds to send the children for treatment, on account of the supposed pain from the injection of the drug. But after the results of the first cases were made known, the demands for admission were greater than I could comply with. So much so, that six selected cases had to be sent home immediately after the injection, and were visited afterwards.

2. As shown in the following table, the ages of the patients vary from 3 to 17 years old, and, of course, the dose of salvarsan varied accordingly, the full dose for an adult being nine grains or six decigrams.

3. I need not go into detail as to the physical condition of each case on admission. They were all more or less covered with the usual yaws tubercles, encrusted granulomata, and papular rashes. Some of the patients could scarcely walk on account of the frambœsial ulcers of the toes. They were dull in appearance and badly fed.

4. But a week after the injection their skin began to show a healthier appearance, the granulomatæ began to disappear, and the ulcers healed rapidly.

5. A few medical men use the salvarsan suspended in olive oil; I use simply sterile water, in which I dissolve the drug, 180 minims to nine grains or six decigrams of salvarsan. In each case, ethyl chloride was used in spray on the skin to avoid or at least diminish the pain of the injections, which were made intramuscularly, into the chitial muscles. Of course, all necessary antiseptic precautions were taken, and in no case was there any reaction of a dangerous nature. Slight pain and fever followed in nearly every case, but disappeared, generally, on the third day after the injection.

6. All the cases (minus the four last ones injected on the 16th and 19th May, and which are doing well) were discharged quite cured from all appearance of the disease, looking and feeling bright and healthy.

7. The average stay for a cure is three weeks.

8. Of course, it is too soon to say that all the cases are permanently cured, and they were all instructed, when leaving the ward, to report to me or my successor the slightest symptom of recurrence.

9. As much as possible I finish with one locality before admitting patients from another, so as to avoid leaving behind any focus of infection, whereby those returning home cured might be reinfected.

10. The six cases sent home immediately after the injections of salvarsan are also successful, but care should be taken in the selection of such patients.

11. I also treated three cases of syphilis with salvarsan; one, a policeman with primary chancre, who was well enough to return to his work two weeks after the injection.

The other case was that of a little Portuguese boy, nine years old, affected with tertiary accidents of hereditary syphilis. He was admitted in a wretched state, emaciated, covered with ulcers, and had an enlargement of the tibia bone; on his face, below the right eye, was a large and unhealthy ulcer with serrated edges, deep enough to receive a small fowl's egg. This boy, whom Your Honour saw on the day of his admission, in such a pitiable condition, is doing well to-day. All the ulcers are healed and the boy eats and feels well. It is too soon yet to discharge him, as his parents are very poor, and he is in need yet of proper food. The third case of syphilis is progressing at home.

12. The one case of filaria which received two injections, the last a month ago, is also progressing favourably. The swelling and hardness of both lower limbs are disappearing gradually. But it is too soon to speak of this as a cure.

13. I claim no merit whatever in the splendid results of these 31 cases treated with salvarsan, as I simply followed the footsteps of those who experimented before me, especially the method and technique of Dr. Numa Rat, who was so successful in his cases at the Alexandra Hospital in Nevis. The only addition to my treatment is thymol, which I administer as a routine treatment on account of ankylostomiasis, which is rather prevalent amongst the children of the labouring class; and tincture of iodine, which I use on the ulcerated granulomata.

I think a monument should be erected to the eternal memory of Ehrlich, the discoverer of salvarsan, as one of the greatest benefactors to suffering humanity.

I have, &c.,
J. A. FOREMAN,
Medical Officer,
Yaws Ward, Sandy Point.

Dr. W. B. CUNNINGHAM, Acting Medical Officer, No. 4 District, to HIS HONOUR THE ADMINISTRATOR.

In reply to Your Honour's minute of 1st September, I beg to make the following statement for transmission to the Secretary of State.

Since I took charge of the yaws ward on 7th June I have had 16 cases under my care. Three of these, when I arrived, had developed abscesses at the site of the salvarsan injection, and this prevented me getting in fresh cases as soon as I should have liked. The remainder were cured with the one injection.

I have the honour to give you the following list, with names, age, and dose of injection given in each case:—

Name.	Age.	Sex.	Dose of Injection.	Date of Discharge	—
	Years.		Grs.		
Nathaniel Payne	11	Male	5	2 July, cured	
Walton Hodge	8	„	4	5 August, „	
James Gordon	7	„	4½	25 July, „	
Hamilton Taylor	8	„	4½	1 July, „	
Carmen Lespere	8	Female	4½	26 June, „	
Ellen Gactan	9	„	4½	At home „ (Not in ward.)	
John Gaton	7	Male	3	24 July, cured	
Susannah Dolphin	3	Female	2	22 July, „	
Abraham Edinburgh	7	Male	2	29 July, „	
Beryl Lespair	11	Female	4½	30 August, „	2nd injection given.
Herbert Eddie	4	Male	2½	29 August, „	
Albert Thomas	5	„	2	Cured, ready for discharge.	
Pearl Bradshaw	8	Female	3½		
Richard Stewart	8	Male	3½		
Alfred Godwin	6	„	3		
Marion Harris	12	Female	6		

W. B. CUNNINGHAM,
Medical Officer, Acting No. 4.

5th September, 1913.

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No. 12.

MALAY STATES.

The HIGH COMMISSIONER to the SECRETARY OF STATE.

(Received 30 June, 1913.)

Sir, Government House, Singapore, 4th June, 1913.

With reference to my despatch of 25th November, 1912,* I have the honour to transmit a report on the work done at the Institute for Medical Research, Kuala Lumpur, for the half-year ending 31st March, 1913.

I have, &c.,
ARTHUR YOUNG.

Enclosure in No. 12.

Report from the Institute for Medical Research for the period October 1st, 1912, to March 31st, 1913.

The Prevention and Cure of Beri-Beri.

Information has been received from Dr. Wollaston and Mr. Kloss concerning the results of their recent explorations in New Guinea.

On all previous expeditions to that country the coolies employed for purposes of transport have been decimated by beri-beri. These coolies are rice-eaters.

As no rice can be obtained in the interior, that food-stuff must be carried in quantities sufficient for their needs throughout the entire period of the expedition. The coolies are accustomed to and prefer polished rice; to this is to be attributed, as our researches have shown, the previous disasters.

On this occasion Dr. Wollaston and Mr. Kloss decided that only unpolished rice should be taken. These gentlemen have now accomplished their work and are able to record that among 240 coolies, employed for a period of seven months in the wilds of New Guinea, not a single case of beri-beri occurred. A striking and convincing proof of the accuracy of our work.

In case of unforeseen occurrences the expedition was furnished with a supply of our remedial agent, but not a single dose of it was required.

As regards the value of this remedial agent in the treatment of sufferers from beri-beri, it is unfortunate that progress cannot be recorded. The question of hospital accommodation would appear to furnish difficulties which, up to now, have not been overcome.

Leprosy.

Experiments have been continued with a view to the cultivation of the bacillus of leprosy.

The procedure by which material is obtained, and which was described in detail in the report for the preceding six months, is invariably employed because of the excellence of the results.

It is stated that the bacillus of leprosy requires an abundant supply of oxygen, and therefore cannot be grown in rubber-capped tubes; certainly no culture of the lepra bacillus has been obtained by us when this procedure was employed. If the tubes are placed in the ordinary way in the incubator dessication occurs and the medium becomes unsuitable. To obviate this, incubation in moist chambers has been recommended, but in our experience the method is unsatisfactory. Moulds rapidly form on the plugs and, unless great precautions are taken, the media become contaminated. Satisfactory results have been obtained by incubation in the ordinary way and from time to time adding, by means of sterile Pasteur pipettes, sterile distilled water to replace the water of condensation lost by evaporation. By this procedure it has been possible to keep inoculated media under observation for nine months.

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* No. 6 in Appendix VI. in [Cd. 6669].

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Experiments with blood media.

In continuation of the work previously recorded under this heading, inoculated tubes incubated aerobically at 37° C. have now been under observation for nine months, but in no instance has a culture been obtained.

Fresh tubes of media have been inoculated with material from other cases, but with similar results.

Further attempts have been made to induce the organisms to grow under anaerobic conditions. Alkaline-blood-nutrient-agar and + 10 blood-nutrient agar containing, in addition to the constituents already mentioned, 1 per cent. of glucose were employed. Once a week the tubes were moistened in the usual way and anaerobiosis restored. These tubes have now been under observation for one month, but without result.

Experiments with blood serum.

Under aseptic precautions blood was collected from normal individuals and lepers. The blood in quantities of 10 c.c. was placed in sterile test-tubes and when clotted the serum was transferred to sterile test-tubes. The serum was inactivated by heating at 56° C. for thirty minutes. Twelve tubes containing leper-serum and twenty containing normal serum were prepared in this way. Two nodular cases of leprosy furnished the material with which the tubes were inoculated.

Six inoculated tubes of leper-serum and nine inoculated tubes of normal serum were incubated anaerobically at 37° C. Once a week or thereabouts the cultures were removed and examined. Sterile distilled water was then added to the tubes requiring it, in order to bring the fluid up to its original volume, and anaerobiosis restored. One tube was found to be contaminated with a stout non-acid-fast bacillus on the occasion of the first examination, the remaining tubes show neither macroscopically nor microscopically that proliferation of the bacilli has occurred.

Seven inoculated tubes of leper serum and eleven inoculated tubes of normal serum were incubated aerobically at 37° C. The original volume of fluid contained in each tubes was restored from time to time by the addition of sterile distilled water In none of the tubes has proliferation of the leprosy bacilli been observed.

These experiments have now been in progress for three months and twenty days.

Experiments with Bayon's placental agar.

In continuation of the previous report, the tubes of this medium inoculated with nodules of leper-tissue have now been under observation for six months and five days. In none of the tubes is growth apparent. There is persistence but not proliferation of the acid-fast bacilli.

Experiments with Duval and Wellman's placental agar.

In continuation of the previous report, the tubes of this medium, inoculated with nodules of leper tissue, have now been under observation for five months and twenty days.

In none of the tubes is growth apparent. There is persistence but not proliferation of the acid-fast bacilli.

Experiments with serum-agar.

Serum was obtained in the manner described under experiments with blood-serum.

Alkaline-nutrient-agar, with and without one per cent. glucose, and + 10 nutrient-agar, with and without glucose, contained in tubes in quantities of 5 c.c., were melted and cooled to 60° C.; each tube then received an equal quantity of serum. The mixtures were allowed to set as slopes. After incubation for 48 hours at 37° C. to test their sterility, each tube received a portion of a leproma.

The tubes containing glucose media were incubated anaerobically and the others aerobically.

Eight tubes of alkaline-serum-nutrient-agar were inoculated from four cases, and eight tubes of alkaline-serum-glucose-nutrient-agar were inoculated from four cases.

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REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Eight tubes of + 10 serum-nutrient-agar were inoculated from four cases and eight tubes of + 10 serum-glucose nutrient-agar were inoculated from four cases.

On incubation several of the tubes of + 10 serum-nutrient-agar showed minute dew-drops either adjacent to or at some distance from the nodule. On examination the dew-drops were found to contain leprosy bacilli. The question arose, were these dew-drops colonies or merely droplets of moisture exuded from nodules swarming with leprosy bacilli? To decide this point subcultures were made of the nodule and of the dew-drops. The experiments are still in progress.

Experiments with serum-water.

Blood was drawn from the jugular vein of a sheep and the serum separated. The serum was mixed with distilled water in the proportion of one of the former to three of the latter. The serum-water was filled into tubes and in the case of those destined for anaerobic cultures, a thick layer of oil (*Paraffinum liquidum* B.P.) was poured on the surface. The media were sterilised by heating for half an hour at 100° C. on three successive days.

Eight tubes for aerobic culture were inoculated with pieces of leper-tissue obtained from four cases and thirteen tubes for anaerobic culture were inoculated from five cases. The inoculated tubes have now been under observation for 24 days and no culture has been obtained.

Experiments with salt solution.

Tubes containing salt solution were prepared for aerobic culture and for anaerobic culture with oil as described in the previous section.

Five tubes for aerobic culture were inoculated from three cases and eight tubes for anaerobic culture were inoculated from four cases. The inoculated tubes have now been under observation for 24 days and no culture has been obtained.

Experiments with Ringer's fluid.

Tubes containing Ringer's fluid were prepared for aerobic culture and for anaerobic culture with oil as described under serum-water.

Five tubes for aerobic culture were inoculated from three cases and eight tubes for anaerobic culture were inoculated from four cases.

The inoculated tubes have now been under observation for 24 days and no culture has been obtained.

Experiments with milk-agar.

Alkaline-glycerine-nutrient-agar was mixed with fresh milk in equal proportions. The mixture was transferred to tubes and sterilized by steam. Nineteen slopes of this medium were inoculated from three cases.

The inoculated tubes have now been under observation for 24 days and no culture has been obtained.

Milk did not form a homogenous preparation with + 10 glycerine-nutrient-agar and the mixture did not appear suitable.

Material for purposes of cultivation has now been obtained from thirty-two non-ulcerating, nodular cases of leprosy and three hundred and seventy-three inoculations made on the various culture-media described in this report and the preceding one.

It is curious, in view of the findings of other investigators, that we have consistently failed to obtain a culture of the *Bacillus leprae.* There can be no doubt but that, on every occasion, material swarming with bacilli has been employed. The microscopical examinations carried out on every case have clearly demonstrated this.

From the examinations made of nodules which have been incubated on culture media for periods ranging from a few days to nine months, no evidence was obtained that the bacilli had increased or lessened in number.

Investigators who have recorded an increase in the number of organisms as a result of microscopical examination must surely have failed to observe the bacterial richness of the material employed for inoculation.

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Anyone who has examined smears prepared from freshly excised leper-tissues must be struck with the enormous masses of acid-fast bacilli present, and how it is possible to state, in a case where no macroscopic growth is apparent, that an increase recognisable only by the microscope has occurred is to me incomprehensible.

Contaminating Micro-organisms.

These may, for convenience, be grouped into

(1) contaminating micro-organisms introduced with, or at the time of introducing, the nodule;

(2) contaminating micro-organisms introduced subsequently, either by growing through the cotton-wool plug or during the manipulations entailed by the moistening of the media.

In the early stages of our investigations, and before sufficient technical skill had been acquired, it not infrequently happened that contaminated nodules were inoculated on the media.

On incubation the presence of these organisms was demonstrated by the occurrence of a macroscopic growth, visible as a rule within a few days. Colonies of staphylococci call for no special comment. On occasions the nodule showed, on blood-media, a brownish growth, at first limited, but gradually spreading over the surface of the medium either as a continuous brownish growth or as isolated brownish colonies. On examination these growths were found, in certain instances, to consist of a slender non-motile rod mixed with large coccoid spores. This organism is of importance because it would appear that observers have mistaken such spores when stained by the Ziehl-Neelsen method for acid-fast organisms. This bacillus grows freely on ordinary agar forming a yellowish crinkled growth.

In this connexion reference must be made to Bayon's acid-resisting and acid-fast organisms. Anyone who has worked with acid-fast organisms must be aware of the power with which these germs retain the carbol-fuchsin. To describe germs as acid-resisting because, after momentary immersion in weak acid, they retain the carbol-fuchsin is wrong. It is an attempt to explain his transition stages from a non-acid-fast streptothrix to an acid-fast bacillus; this is, in our experience, unsound and misleading.

Diphtheroid organisms have also been isolated, but these organisms are ubiquitous and demand no special consideration. Even granting that either of these contaminating bacilli had a genetic relationship with the bacillus of leprosy, it is strange that in ten tubes of the same media inoculated by us with pieces of leprous tissue from one nodule and swarming with acid-fast organisms only one should develop a growth of a non-acid-fast organism. It is impossible to believe that in this nodule there was only one part of it in which a living acid-fast germ was present, and that that germ should on proliferation give rise to a non-acid fast organism growing freely on ordinary media.

In other instances the growth was found to consist of a streptothrix which grows readily but slowly on + 10 nutrient-agar in the form of orange-red colonies, and on alkaline-nutrient-agar in the form of greyish brown striated colonies.

Smears prepared from nodules contaminated with either a streptothrix or a bacillus invariably show masses of leprosy bacilli, because these organisms are so abundant in the tissues employed. If from an emulsion of such a nodule a tube of nutrient agar is inoculated, a growth will readily be obtained, and smears prepared from this growth may show the presence of some acid-fast bacilli because these organisms have been so numerous in the inoculated material. In the second subculture on nutrient agar acid-fast bacilli may or may not be found; most probably not.

The fact that these contaminating organisms grow in the first subculture on + 10 nutrient-agar is strong evidence against them having originated from leprosy bacilli and from the numerous examinations made I have no hesitation in stating that they have no connection with the *Bacillus lepræ*. Several investigators have described in detail the gradual transformation of the acid-fast bacilli into non-acid-fast organisms. They must have been led into error by the mechanical transference of non-proliferating acid-fast organisms along with freely-growing non-acid-fast saprophytes. I know of no organism with strongly parasitic characters whose sapro-

phytic existence can only be stimulated by the use of special media and which will grow freely, if at all, in the first sub-culture on ordinary media.

The organisms belonging to the second group are similar to those mentioned in the first group. Very infrequently moulds have been met with.

As a type of the contaminations met with the following instance may be quoted. On the 9th September, 1912, eight tubes of alkaline-glycerine-blood-agar were inoculated with pieces of a leproma rich in bacilli. On the 16th September the piece of tissue in one of the tubes showed a growth. Smears showed the presence of a spore-bearing bacillus and groups of acid-fast bacilli. The contaminator grew freely on + 10 nutrient agar.

On the 6th January, 1913, another of the tubes was observed to be contaminated. A brownish growth spread upwards from the water of condensation, but there was an interval of about three-quarters of an inch between the upper margin of the growth and the piece of leprous tissue. That interval was free from the growth which on examination proved to consist of staphylococci and a streptothrix. In smears prepared from the nodule there was the usual abundance of acid-fast bacilli but no non-acid-fast bacilli and no streptothrix. Clearly, therefore, the streptothrix could not have originated from the lepra bacillus.

Subcultures on + 10 nutrient agar were prepared and the streptothrix isolated. An entire culture on + 10 bouillon, seven days old, was injected into the peritoneal cavity of a guinea-pig. The animal did not become in any way affected. Forty days later it was killed and all the organs appeared healthy.

An entire culture on + 10 bouillon, fourteen days old, was injected into the peritoneal cavity of a guinea-pig. Ten days later the animal died. The animal was well nourished and presented no external lesions. On opening the abdomen the great omentum was found to be rolled up and matted together, forming a sausage-shaped mass. This mass was full of caseous and purulent tubercles, mostly about the size of a pin's head. There was a small tubercle on the surface of the bladder, two on the right seminal vesicle, and a group of them on the under surface of the diaphragm. The superior mesenteric glands were enlarged and contained caseous and suppurating tubercles. The spleen was enlarged and studded with nodules. The kidneys and suprarenal capsules were congested and swollen but contained no nodules.

On opening the thorax the upper part of the right lung was found to be solid and caseous. In the centre of the inferior lobe there was an aggregation of tubercles surrounded by congested lung tissue.

Smears from the omentum showed the presence of the streptothrix mixed with cell-debris and cocci. The streptothrix was Gram-positive but it stained poorly and had a granular, degenerate appearance.

The tubercles in every instance showed the same histological characters. The microscopic appearance of those in the lung was similar to that of the nodules which were found in the mesenteric glands and omentum. The tubercles consisted of sharply defined masses of irregular necrotic nuclei imbedded in amorphous debris which stained pink with eosin. They were not surrounded by epithelioid cells, fibrous tissue or small cell infiltration. Except in the lung, they were surrounded by healthy tissue and did not appear to have given rise to any inflammatory reaction. No blood-vessels penetrated the substance of the tubercles and there were no pathological changes in the capillaries of contiguous tissues.

The tubercles within the mesenteric glands were situated in the neighbourhood of the divisions of the afferent lymphatic vessels which supply the cortex.

In the liver there were no macroscopic lesions, but microscopically numbers of tubercles were found in the portal spaces and in the portal zones of the lobules. It was possible to recognize the remains of degenerate liver cells lying amidst the necrotic material which formed these minute nodules, but the trabeculae surrounding the tubercles appeared normal.

Within the lung, the nodules did not lie in healthy tissue but were surrounded by a zone of consolidation in which the alveoli and bronchioles were blocked by masses of catarrhal cells. External to this the capillaries were intensely congested and the alveoli were filled with a fluid exudate.

The presence of the streptothrix was not demonstrated in the lung, but it was found in sections of the lymphatic glands, mesentery and liver where it was similar in

character to that seen in the smears made from the fresh organs. No acid-fast organisms were found in any of the sections or smears.

The unsatisfactory results recorded in connection with the use of Nastin are nothing more than might have been expected. It was, even considered in its most favourable light, only an attempt to cure a disease with an extract prepared from an organism which was not the cause of the disease. It was admitted by Deycke that the organism was only a commensal and our researches have shown that it is not even a constant one.

Benzoyl chloride is itself a powerful corrosive substance; tissues placed in it are rapidly disintegrated and the momentary immersion of a section of tissue swarming with acid-fast bacilli suffices for their complete removal, but the cells of the tissue are also removed. The use of this reagent would, therefore, not appear to be advisable in the treatment of leprosy.

As regards the work of Williams and Rost, in the report for the preceding six months the failure to obtain a culture by the methods they employed was recorded. The reports, more especially those of Williams, convey the impression that this investigator has been misled by contamination. This may for a time be a matter of opinion, but the conclusion here stated is based on a large number of observations and, if correct, it is only a matter of time until the use of these vaccines is discarded.

Experiments on Animals.

In view of our failure to confirm the work of other investigators who claim to have cultivated the *Bacillus lepræ* and our failure with the various other culture media which we have employed, it was considered desirable to carry out experiments on animals with a view to determining to what animals and under what conditions the disease could be transmitted. It was further considered possible that if the disease could be transmitted to animals a culture of the bacillus might be more readily obtained.

Animals to whom the disease could be transmitted would be certain to show lesions of some description and it would thus be possible to compare them with those produced by the inoculation of any culture which we had reason to believe was that of the bacillus of leprosy.

Neither by the method of complement fixation nor by that of temperature reaction induced in lepers by the injection of extracts and vaccines prepared from cultures have satisfactory results in respect of identification been obtained.

An intelligent Chinaman came to the Institute on the 22nd August, 1912, suffering from leprosy. He stated that the first coloured patch was observed on the face by him in March, 1911, on that occasion he had fever. A few days later other patches appeared on the face. Three months later these patches had disappeared and the patient continued apparently in good health until June, 1912. He then had fever, the patches on the face reappeared, and on the occasion of his coming under observation he stated that the patches were increasing in size.

It was noted that there were four red patches on the face and smears prepared from one of these showed numerous leprosy bacilli. The right ulnar nerve was much thickened; there was some wasting and paresis of the right forearm, on which there were also some patches. There were several patches on other parts of the body.

In view of the statement made by various investigators that in lepromata, which have existed for some time, the bacilli are dead, it was reasonable to assume that in these recently developed patches live leprosy bacilli would be present.

From a patch on the right cheek a bloody fluid, proved to contain bacilli, was expressed, emulsified in sterile salt solution and inoculated into the supraorbital region of a gibbon (No. 3). A slight reaction developed at the site of inoculation, but this soon disappeared and the animal did not appear to be affected in any way. On the 27th December, 1912, under local anasthesia a pocket was made in the right supraorbital region of the gibbon and a nodule of leper-tissue was inserted. On the 17th January the animal was found to be suffering from dysentery. On the 21st January it died and a post-mortem examination confirmed the accuracy of the clinical diagnosis. In sections prepared from the skin and subjacent tissues at the site of inoculation acid-fast bacilli were not found. It was not possible to prepare thin sections

and it is quite possible that the nodule of tissue was overlooked. No evidence was obtained to show that a successful transmission of the disease had been made. Multiple teratomata were observed and on account of the interesting findings, a detailed description of the conditions is given in another place.

Under cocaine an incision was made with a Graefe's knife in the right cornea of a rabbit (No. 1), a freshly excised nodule of leprous tissue was then introduced into the anterior chamber between the iris and the cornea at the upper part. Another rabbit (No. 2) was similarly treated. Both operations were successful; but after three months there is nothing to indicate that a transference of the disease has been effected.

Three wild rats were kept in captivity for three weeks and each then received a nodule of leper-tissue introduced into a pocket made at the root of the tail. On the following day one (No. 4) of the rats was found to be very ill, it was found to be suffering from trypanosomiasis and by noon was dead. Post-mortem nothing of note was observed. A week or so later one of the rats escaped. The remaining rat (No. 5) is after three months apparently unaffected.

On the 7th March, 1913, four rabbits (Nos. 6, 7, 8, 9) each received a piece of leper-tissue in the anterior chamber of the right eye. The method employed was the same as that above stated and the material was obtained from three different cases of the disease.

On the 11th March, 1913, four other rabbits (Nos. 10, 11, 12, 13) were similarly inoculated. On the same date three rats which had been in captivity for some weeks were inoculated. In one the nodule of leper-tissue was inoculated into the scrotum and in the two others the site of inoculation was at the root of the tail.

On the 12th March, 1913, three guinea-pigs (Nos. 17, 18, 20) were inoculated with material from a leper. The site of inoculation was in one case the scrotum and in the other two cases the tunica vaginalis. On the same occasion a rabbit (No. 19) was inoculated with a nodule in the anterior chamber of the right eye.

All the operations were successful and it is necessary to emphasise the fact that in each instance a nodule swarming with leprosy bacilli was inoculated.

These experiments are to be continued and extended.

No.	Animal.	Date of inoculation.	Site of inoculation.	Material inoculated.	Interval between removal from body and inoculation.	Case No.	Remarks.
1	Rabbit ...	27 December, 1912	Anterior chamber of right eye.	Portion of leproma	1 hour ...	24	
2	Rabbit ...	27 December, 1912	Do. do.	Do. do.	1 hour ...	24	
3	Gibbon ...	22 August, 1912 ...	Supraorbital region.	Emulsion of juice expressed from erythematous patch.	½ hour ...	20	Re-inoculated, 27 December, 1912, in right supraorbital region with portion of leproma from case 24
4	Wild rat ...	27 December, 1912	Root of tail ...	Portion of leproma	1½ hours ...	24	
5	Wild rat ...	27 December, 1912	Do. ...	Do. do.	1½ hours ...	24	
6	Rabbit ...	7 March, 1913 ...	Anterior chamber of right eye.	Do. do.	24 hours ...	28	
7	Rabbit ...	7 March, 1913 ..	Do. do.	Do. do.	½ hour ...	29	
8	Rabbit ...	7 March, 1913 ...	Do. do.	Do. do.	¼ hour ...	30	
9	Rabbit ...	7 March, 1913 ...	Do. do.	Do. do.	2 hours ...	30	
10	Rabbit ...	11 March, 1913 ...	Do. do.	Do. do.	1¼ hours ...	31	
11	Rabbit ...	11 March, 1913 ...	Do. do.	Do. do.	1½ hours ...	31	
12	Rabbit ...	11 March, 1913 ...	Do. do.	Do. do.	2 hours ...	31	
13	Rabbit ...	11 March, 1913 ...	Do. do.	Do. do.	2 hours ...	31	
14	Wild rat, male.	11 March, 1913 ...	Scrotum	Do. do.	2¼ hours ...	31	
15	Wild rat, female.	11 March, 1913 ...	Root of tail ...	Do. do.	2½ hours ...	31	
16	Wild rat, female.	11 March, 1913 ...	Do. ...	Do. do.	3 hours ...	31	
17	Guinea-pig, male.	12 March, 1913 ...	Scrotum	Do. do.	1 hour ...	32	
18	Guinea-pig, male.	12 March, 1913 ...	Tunica vaginalis	Do. do.	1 hour ...	32	
19	Rabbit ...	12 March, 1913 ...	Anterior chamber of right eye.	Do. do.	1¼ hours ...	32	
20	Guinea-pig, male.	12 March, 1913 ...	Tunica vaginalis	Do. do.	1½ hours ...	32	

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Blackwater Fever.

Dr. Fletcher has continued his researches on this subject and furnishes the following report :—

There was included in the last report a note on the investigation of seven cases which had occurred in different parts of the country and had been diagnosed as blackwater fever; attention was drawn to the result of this investigation, which was to confirm the diagnosis in only two of the cases.

During the past six months, through the courtesy of our colleagues, material from the six following cases has been received.

H. Urine and blood smears of a Chinese from the District Hospital, Kuala Lumpur. The urine contained a large number of erythrocytes. The patient died on the day after the examination was made and, at the autopsy, a perforating ulcer was found in the bladder.

I. Urine only of a European living at Sungkai in Perak. This patient was said to suffer frequently from malaria and to have had an attack of blackwater fever a year before. The urine was rather high coloured but contained no erythrocytes, haemoglobin or albumen.

J. Urine and blood of a European planter who had been in the country for about twelve months, working at Seremban, in Negri Sembilan. He had suffered much from fever and was in the habit of taking quinine and aspirin irregularly. When he was admitted to the Seremban Hospital his urine was quite black and had been so for two days. His temperature was 102° F., but no malarial parasites were found in the blood. He was treated with quinine in the usual doses employed in the treatment of uncomplicated malaria and also received calcium chloride.

When his urine was examined here, on the sixth day of his illness, spectroscopic examination showed no trace of haemoglobinuria, but the urine contained a little albumen and the yellow granular casts which are generally seen in cases of blackwater fever. No malarial parasites or other protozoal organisms were found in the blood of this patient.

K. The urine of a patient from Kajang in Selangor, who was thought to be suffering from blackwater fever. This urine was high coloured, but contained no blood, bile or albumen.

L. Urine of a Chinese patient in the District Hospital, Kuala Lumpur. This sample contained erythrocytes and blood clots, the source of which was probably a lesion in the bladder.

M. Urine and blood smears from a planter in Seremban, who had lived for four-and-a-half years in the Federated Malay States and had suffered, during the whole of that period, from frequent attacks of malaria, for the cure of which it was his custom to take quinine and aspirin. On the third day of his last attack of fever, for which he was taking quinine as usual, his urine became black and he was admitted to hospital on the following day. His urine, which was the colour of porter, contained methaemoglobin and a few casts. No parasites were found in his blood. He was given quinine intramuscularly and by the mouth. His urine became clear on the 4th day.

Two of the above cases (J and M) were undoubtedly suffering from blackwater fever. Of the others, the urine in cases I and K was ordinary febrile urine containing neither blood nor albumen, while cases H and L were suffering from gross lesions of the bladder.

During the past twelve months, thirteen cases have been investigated in which a diagnosis of blackwater fever had been made. In only four of these was the diagnosis confirmed.

Towards the close of 1912 the following circular was sent to all medical men in the Federated Malay States :—

Blackwater Fever in the Federated Malay States.

> During recent years, as you are aware, the number of cases of blackwater fever occurring in this country has increased.
>
> We have endeavoured to investigate the cases and would ask for your kind co-operation in the continuance of this work.

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You will doubtless appreciate the advantages to be derived from the investigation of these cases and the collection of information regarding the distribution of the disease.

Our work, on the limited amount of material so far available, has revealed the interesting fact that a considerable proportion of the cases diagnosed clinically as blackwater fever are in reality not cases of that disease.

We are prepared to assist you in every way possible in this matter since it is of the utmost importance to obtain reliable statistics on the incidence of this serious disease.

When a case comes under your observation we would ask you to inform us without delay by telegram or otherwise. We will then, if you are agreeable, visit the patient and collect a specimen of the urine for spectroscopic examination.

We will then, with your co-operation, follow the course of the case and, should a fatal result ensue, be prepared to carry out an autopsy.

The Director,
Institute for Medical Research,
Kuala Lumpur, F.M.S.

Malaria.

During 1911 this disease was apparently more prevalent in the Federated Malay States than in previous years. In that year, the inhabitants of the Straits Settlements, Ceylon, and other Oriental countries also suffered severely from the disease.

Towards the close of 1911 the severity of the epidemic had declined and during 1912 there was not, apparently, a recrudescence.

In the Federated Malay States the appreciable decline in some parts of the country has been attributed to the removal of surface water by means of subsoil and other drains.

It is therefore of interest to record the findings in a place where none of these measures have been employed and where the breedings grounds of mosquitoes have not been diminished.

The settlement of Gemas was created by the extension of the railway; it is the junction of the east and west coast railways.

In 1911 the railway officials stationed there suffered severely from malaria and considerable difficulty was experienced in keeping them there.

In August of that year Dr. Fletcher was asked to visit Gemas. Eighty-nine per cent. of the officials complained of having had fever in Gemas and in fourteen out of forty blood-films examined the parasites of malaria were found.

In August, 1912, blood films prepared from fifty of the officials were examined, and parasites found in nine.

In February, 1913, only thirty-three per cent. of the officials complained of having had fever in Gemas, and in blood-films, prepared from fifty-four people, parasites were only found in seven cases.

Evidence has also been obtained from other places. The results might be considered as a control to those claimed to have been obtained in drained areas. It may be that, quite apart from the question of surface water, the incidence of anophelines varies just as has been observed in the case of other insects. Certainly, in the case of Gemas there is no lack of places suitable for the breeding of anophelines. It is possible that in the spread of this disease there are factors which have either not been discovered or not been accurately defined.

The Anopheles Mosquitoes of Malaya and their Larvae with some Notes on Malaria-carrying species.

Dr. Stanton furnishes the following report :—

In connection with the investigation of factors concerned in the spread of malaria, carried out during the years 1911 and 1912, the anopheles mosquitoes of Malay Peninsula have been specially studied. In conjunction with Major S. P. James, of the Indian Medical Service, types of the Indian species were compared with Malayan species, and in order to clear up doubts as to the systematic position of certain species, it was further necessary to study the collection of types preserved at

the British Museum of Natural History in London. The latter work I had the opportunity of carrying out during my recent leave of absence, and in this connection I would acknowledge my indebtedness for numerous courtesies extended to me by Lieut. Col. A. Alcock, C.I.E., F.R.S., Mr. E. E. Austen, Heads of the Departments of Entomology at the London School of Tropical Medicine and the British Museum respectively, and Mr. F. W. Edwards, who has charge of the British Museum collection of Culicidae.

Since the publication of the monograph by Drs. G. F. Leicester and C. W. Daniels on "The Culicidae of Malaya" in 1908, several new observations have been made which appear to be of sufficient value to justify a revision of the group of Malayan anopheles. An examination of specimens from different countries in the Oriental region and of the types preserved in the British Museum of Natural History has shown that much confusion still exists in mosquito nomenclature. In certain cases the same mosquito is known under different names—for example, *fuliginosus* of India is identical with *nivipes* of Malaya; while in other cases different mosquitoes are known under the same name—for example, *willmori* of Malaya (Leicester) is different from *willmori* of India (James and Liston). One regrettable result of this confusion is that the knowledge gained of malaria-carrying species in one country is rendered valueless in its application to the circumstances of the other.

In order to avoid the vexed question of the generic classification of anophelines, all the species here dealt with are referred to the genus Anopheles. In a department of zoology where so much uncertainty still exists as to the characters of species it seems little profitable to complicate matters further by attempting at present to define the limits of genera or subgenera.

In those cases in which the mature forms of the larvæ are known, a brief description is given of the characters which are of value in the differentiation of species. These characters are in particular the form and arrangement of (1) the four anterior clypeal hairs, here called the inner and outer pairs of anterior clypeal hairs, and (2) the two posterior clypeal hairs, both of which groups are situated on the front of the head, and (3) the palmate hairs, situated laterally on the thorax in some species and on a varying number of the abdominal segments.

In the course of the present study it was discovered that, contrary to what had hitherto been believed, the form and arrangement of the clypeal hairs of anopheles larvæ varied at different stages of the larva's life. The observations made in connection with this matter will be considered more in detail later, but it may here be mentioned that, when they leave the eggs, anopheles larvæ of whatever species are very much alike, at any rate in those features which are commonly supposed to exhibit constant specific differences, and that it is only in the later stages that their distinctive characters are developed. These facts explain the anomalous results obtained by previous workers in this field of study.

Anopheles aitkeni, James, 1903.
Anopheles aitkeni, James in Theobald, 1903.
Stethomyia fragilis, Theobald, 1903.
Anopheles treacherii, Leicester, 1908.
Neostethopheles aitkeni (James & Liston, 1911).

This is the only unspotted winged anopheles so far recorded from the Malay Peninsula. It is remarkable for its frailness and for its culex-like attitude when at rest.

This species has been suspected to be a transmitting agent of malaria, but there is no evidence in support of this suspicion.

Larva.—The larva is short, and the unusually broad thorax gives it a stumpy appearance. The inner anterior clypeal hair is frayed in its basal two-thirds and simple at the end; the outer anterior clypeal hair is simple; the posterior clypeal hair is branched. Palmate hairs are present on the thorax and on the first to seventh abdominal segments.

Anopheles umbrosus, Theobald, 1903.
Myzorhynchus umbrosus, Theobald, 1903.

This species usually shows only one white spot on the wing costa, but in many

specimens there are two spots. The latter variety is stated to be a malaria carrier. Five trials by the writer failed to show any development of the parasites of subtertian malaria in this species.

Larva.—The inner anterior clypeal hair is simple; the outer anterior clypeal hair is branched, four or five divisions springing from a single stem; the posterior clypeal hair is branched. The antenna bears a long branched hair on its inner side. No leaf-like palmate hairs are present on either thorax or abdomen; this remarkable character was not noted in the mature larva of any other species of anopheles.

Anopheles asiaticus, Leicester, 1904.
Lophoscelomyia asiatica, Leicester, 1904.

This species is recorded by Dr. Leicester as "exclusively a bamboo breeder." The larva has not yet been described. A specimen of anopheles recently received by the writer from Dr. A. R. Wellington, of Perak, would appear to indicate that this species has affinities with the *umbrosus* group of anopheles.

Anopheles albirostris, Theobald, 1903.
Mysomyia albirostris, Theobald, 1903.

This is a common species in certain parts of the peninsula; it resembles the Indian species *listoni* in appearance, habitat, and in the readiness with which it may be infected with malaria parasites. It has been found infected in nature (sygotes), and the parasites of subtertian malaria readily undergo development in it. It is believed to be an important agent in the spread of malaria in the peninsula.

Larva.—A short, stumpy larva resembling that of *A. aitkeni*. Both outer and inner anterior clypeal hairs are pinnate; the posterior clypeal hair is branched. Palmate hairs are present on the thorax and on the first to seventh abdominal segments; on the thorax and first abdominal segment these are lanceolate, on the other abdominal segments they are broad and jagged at the base of the terminal filament, which is long and sharp-pointed.

Note.—With reference to the species *aurirostris*, Watson, 1910, which is said to differ from *albirostris*, I have not taken any specimens which answer to the description.

Anopheles rossi, Giles, 1899.
Myzomyia rossi (Theobald, 1907).
Pseudomyzomyia rossi (Theobald, 1907).
Nyssomyzomyia rossi (James & Liston, 1911).

This is a very common species everywhere throughout the Peninsula. A large series of dissections and infection experiments failed to show any development of malaria parasites in it.

Larva.—Both anterior clypeal hairs are simple, the inner being long and stout, and the outer very short; the short posterior clypeal hair is simple and is situated internally to the line of the inner anterior clypeal hair. The thorax does not carry palmate hairs—these are present on the first to seventh abdominal segments, the terminal filament being unusually long and sharp-pointed.

Note.—With reference to the species *Anopheles indefinatus*, Ludlow, to the description of which a number of Malayan specimens correspond, it should, perhaps, be considered as a variety of *rossi* rather than a distinct species.

Anopheles ludlowi, Theobald, 1903.
Myzomyia ludlowii (Theobald, 1903).
Nyssomyzomyia ludlowi (James & Liston, 1911).

This species is also a near ally of *rossi*. In the Malay Peninsula it has been taken only in the coast towns.

New interest has been aroused in this species owing to Major Christopher's announcement that he has found it to be a carrier of malaria in the Andamans.

Larva.—No constant difference has so far beeen noted between the mature larva of *ludlowi* and that of *rossi*.

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Anopheles tessellatus, Theobald, 1901.
Anopheles tessellatum (Theobald, 1901).
Anopheles punctulatus (Theobald nec Dönitz, 1901).
Anopheles tessellatus (Theobald, 1901).
Mysomyia tessellatum (Theobald, 1903).
Nyssomyzomyia punctulata (James & Liston, 1911).

In the first volume of his monograph, Mr. Theobald describes an anopheles from Perak, Federated Malay States, for which he proposed the name *tessellatum.* Before publication, having seen the description of *punctulatus*, Dönitz, he considered the two to be synonymous and used his description as that of *A. punctulatus*, Dönitz. It has now been determined that the two species are distinct, one marked difference being in the palpal banding. Therefore Mr. Theobald's description of what he called *A. punctulatus*, Dönitz, stands good for his own *tessellatus*, which now ranks as a good species.

This is a comparatively uncommon mosquito in the Malay Peninsula and its larva has not yet been identified, nor has any investigation been made of its malaria-carrying abilities.

Anopheles leucosphyrus, Dönitz, 1901.
Myzomyia ? elegans (James in Theobald, 1903).
Pyretophorus elegans (Theobald, 1907).
Neomyzomyia elegans (Theobald, 1910).
Myzomyia "*leucophyrus*" (Leicester, 1908).

Examination of Malayan specimens of Leicester's "*leucophyrus*," Dönitz, shows them to be identical with Indian *elegans*, James, and with *leucosphyrus*, Dönitz.

This species has been met with very infrequently.

Larva.—Both anterior clypeal hairs are simple; the posterior clypeal hair is simple. The thorax does not carry palmate hairs, but these are present on the first to seventh abdominal segments; the leaflets are broad and the terminal filament short and blunt.

Anopheles maculatus, Theobald, 1901.
Anopheles maculata, Theobald, 1901.
Nyssorhynchus maculatus, Theobald, 1903.
Nyssorhynchus willmori, Leicester nec James, 1908.
Nyssorhynchus pseudowillmori, Theobald, 1910.

The nomenclature of this and closely allied species has given rise to more difficulties than any others of Oriental anopheles. An examination of the types of *Anopheles maculata*, Theobald, has revealed a reason for the confusion that has existed in the minds of Eastern workers as to the characters of this species. The types are not male and female of the same species, but represent two distinct species, the male being of the species known to Eastern workers as *maculatus* and the female of the species known to them as *karwari.*

Dr. Leicester in his monograph, page 44, referring to his *Nyssorhynchus willmori,* says: "The mosquito evidently bears a strong resemblance to *Nyssorhynchus maculatus,* specimens of which have been taken at Taiping. It differs, however, in the banding of the palpi. A drawing of the palpi of *maculatus* is given in Theobald's monograph and shows three white bands at the apex instead of two equal bands present in *willmori.*" Dr. Leicester's reference to the drawing is to that on page 101, vol. iii., of Mr. Theobald's monograph, which is in reality a representation of the female palp of the species known to him as *karwari.* In consequence of these difficulties, Dr. Leicester makes the quite excusable error of assigning this common Malayan anopheles to the species *willmori*, an error in which he has been followed by later workers, to the production of endless confusion.

The zoological puzzle represented by these facts it is proposed to solve by retaining the name *maculatus* for the species which is now well known under that name to students of this group in the Orient, and to rename the species which has hitherto been known as *karwari.* It is admitted that this course is open to criticism, on the ground of nonconformity with the strict rules of zoological nomenclature, but other considerations move me to regard it as the most satisfactory.

This species has been found infected in nature both by Dr. M. Watson and by the writer. I have also been able to infect it under experimental conditions with the parasites of subtertian malaria.

Larva.—The inner and outer anterior clypeal hairs are pinnate, the posterior clypeal hair is simple. Palmate hairs are absent from the thorax and first abdominal segment, rudimentary on the second abdominal segment, and fully developed on the third to seventh abdominal segments; the leaflets are broad and notched at the base of the terminal filament, which is short and blunt.

Anopheles nigrans, nom. nov.
Nyssorhynchus karwari, James in Theobald, 1903.

The name of this species is altered for reasons stated under the account of *A. maculatus.*

It is a common Malayan species, the larva of which are frequently found in association with those of *maculatus.* It is stated to be a malaria carrier, but as yet no experimental or other evidence has been recorded in support of this suggestion.

Larva.—The description of the mature larva of *maculatus* applies also to this species. Some minor differences were observed, but it was not possible to satisfy oneself that these were constant.

Anopheles fuliginosus, Giles, 1900.
Anopheles leucopus, Donitz, 1901.
Anopheles jamesii, Liston, 1901.
Nyssorhynchus nivipes, Theobald, 1907.

This species has been found infected in nature both in India by J. R. Adie and in Malaya by the writer, who has also observed the development in it of the parasites of subtertian malaria (zygotes).

Larva.—The inner anterior clypeal hair is much frayed in its terminal three-quarters, the outer anterior clypeal hair is thickly branched; the posterior clypeal hair is branched. Palmate hairs are present on the thorax and on the first to seventh abdominal segments; on the thorax and first abdominal segments these are lanceolate; on the second to the seventh segments they are broad and jagged at the base of the terminal filament, which is long and sharp-pointed.

Anopheles sinensis, Wiedemann, 1828.
Anopheles jesoensis, Tsuzuki, 1902.
Myzorhynchus peditaeniatus, Leicester, 1908.

Tsuzuki states that in Japan this species is the carrier of benign tertian malaria In the Federated Malay States I have seen malaria zygotes in it on two occasions, but was unable to infect it under experimental conditions with the parasites of subtertian malaria.

Larva.—The inner anterior clypeal hair is long and simple, the outer anterior clypeal hair is brush-like. The antenna bears a long branched hair on its inner side. Palmate hairs are present on the thorax and on the first to seventh abdominal segments.

Note.—With reference to the species *Myzorhynchus separatus*, Leicester, 1908, I have been unable to satisfy myself by an examination of the scanty material now available that it is distinct from *A. sinensis.* Leicester's *peditaeniatus* is considered to be a synonym of *sinensis*, as are also *annularis*, Van der Wulp, *vanus*, Walker, and *minutus*, Theobald, which have also been recorded from the Malay Peninsula.

Anopheles barbirostris, Van der Wulp, 1884.
Myzorhynchus barbirostris (Theobald, 1903).

A feature of the Malayan specimens of *barbirostris*, which is not usually noted in descriptions of this species, is the presence on the ventral aspect of the second to seventh abdominal segments of a few white scales. On the second segment these scales are situated on either side of the mid-line and on the other segments in the mid-line. Like the ventral tuft of scales on the eighth segment, these scales are absent in males

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In eight trials it was not possible to infect this species with the parasites of subtertian malaria.

Larva.—In all its constant characters the larva resembles that of *sinensis.*

Anopheles albotaeniatus, Theobald, 1903.

Myzorhynchus albotaeniatus, Theobald, 1903.

This species was described by Mr. Theobald from material sent him by Dr. M. J. Wright, of Perak, Federated Malay States. It bears a general resemblance to *umbrosus*, but the broad banding of the hind tarsi is a distinctive feature. The name is retained for the present and pending an examination of further material.

Anopheles kochi, Donitz, 1901.

Cellia kochii (Theobald, 1903).

Christophersia halli, James, 1910.

Though this species is suspected on epidemiological grounds to be a carrier of malaria, no evidence was obtained to support this view in the few experiments undertaken.

Larva.—The inner anterior clypeal hair is long and slightly frayed at the end, the outer anterior clypeal hair is short and simple; the posterior clypeal hair is simple. Palmate hairs are present on the thorax and on the first to seventh abdominal segments—on the thorax, first and second abdominal segments these are lanceolate, on the third to seventh segments they are broad and jagged at the base of the filament, which is short and blunt.

Table showing Principal Distinctive Characters of Female Malayan Anopheles.

I. With unspotted wings :—

aitkeni ...	... A small brown fragile species. At rest has a culex-like attitude.

II. With spotted wings :—

A. With unbanded palpi :

umbrosus	... Wings usually with only one costal spot and one small apical fringe spot. Palpi lightly scaled. Abdomen without ventral tuft or other scales. Hind tarsi narrowly banded
albotaeniatus	... Wings with two costal spots and black fringe. Abdomen without scales. Hind tarsi broadly banded.
barbirostris	... Wings with two costal spots, one pale apical fringe spot and another opposite lower branch of fifth vein. Palpi heavily scaled. Abdomen with ventral tuft of scales on eighth segment and scattered white scales on second to seventh segments. Hind tarsi narrowly banded.
asiaticus ...	... A species with a distinctive ruff of black and white scales at the apices of the hind femora.

B. Palpi with five white bands :

kochi ...	... A golden-brown species with six prominent tufts of black scales projecting downwards from ventral surface of abdomen.

C. Palpi with four white bands :

sinensis ...	... Four narrow bands. Ventral tuft of scales on eighth abdominal segment.
tessellatus	... Three broad bands and one narrow band. Speckled legs.
leucosphyrus	... One broad apical band and three narrow bands. Speckled legs. Broad white band on hind legs involving lower end of tibia and upper part of first tarsal segment.
nigrans ...	... Two broad bands and two narrow bands. Legs not speckled. Three broad bands on hind tarsi.

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D. Palpi with three white bands :

maculatus ...	Two broad bands and one narrow band. Legs speckled. Three broad bands on hind tarsi.
albirostris ...	Two broad bands and one narrow band. Legs not speckled. Hind legs narrowly banded.
fuliginosus ...	One broad band and two narrow bands. Three segments of hind tarsi white.
rossi	One broad band and two narrow bands. Legs not speckled. Hind tarsi narrowly banded.
ludlowi	One broad band and two narrow bands. Legs speckled. Hind tarsi narrowly banded.

Table showing Principal Distinctive Characters of Mature Larvae of Malayan Anopheles.

A. With none of the anterior clypeal hairs simple :

albirostris ...	Anterior clypeal hairs pinnate. Posterior clypeal hair short, branched. Palmate hairs present on thorax and first to seventh abdominal segments.
maculatus ...	Anterior clypeal hairs pinnate. Posterior clypeal hair long, sometimes forked. Palmate hairs not present on thorax or first abdominal segment.
nigrans	Not distinguishable from *maculatus*.
fuliginosus ...	Inner anterior clypeal hair frayed, outer thickly branched. Posterior clypeal hair branched. Palmate hairs present on thorax and first to seventh abdominal segments.

B. With inner anterior clypeal hairs only frayed :

aitkeni	Inner anterior clypeal hair much frayed in its basal two-thirds. Posterior clypeal hair branched. Palmate hairs present on thorax and first to seventh abdominal segments.
kochi	Inner anterior clypeal hair slightly frayed at the end. Posterior clypeal hair simple.

C. With outer anterior clypeal hairs only branched :

umbrosus ...	Outer anterior clypeal hair slightly branched. No leaf-like palmate hairs on thorax or any abdominal segment.
sinensis	Outer anterior clypeal hair thickly branched. Leaf-like palmate hairs on thorax and first to seventh abdominal segments.
barbirostris ...	Not distinguishable from *sinensis*.

D. With all the anterior clypeal hairs simple.

rossi	Short posterior clypeal hairs between the inner anterior clypeal hairs. Terminal filament of palmate hairs long and sharp-pointed.
ludlowi	Not distinguishable from *rossi*.
leucosphyrus ...	Posterior clypeal hair behind inner anterior clypeal hair. Terminal filament of palmate hairs short and blunt.

In addition to the above species Colonel Alcock has described a specimen from Perak under the name *Anopheles wellingtonianus*, and in Dr. Leicester's collection of Malayan mosquitoes recently presented to the British Museum there is a specimen of his *Pyretophorus watsoni*, the only specimen of this species now available for study. These will be added to the list of Malayan species.

Several interesting observations were made on the parasites attacking anopheles mosquitoes in this country. Series of specimens illustrative of these have been presented to the British Museum and the Schools of Tropical Medicine, and descriptions of them are being undertaken by authorities in the different groups concerned. These include species of Ceratopogon or Culicoides Acarines and protozoal parasites of larvae.

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On the Changes which occur in certain characters of Anopheles Larvæ in the course of their Growth.

Dr. Stanton furnishes the following report :—

It is generally admitted that the ability to determine the species of anopheles by an examination of their larvæ would place a valuable weapon in the hands of the practical sanitarian in tropical countries. In the investigation of an area for the determination of the anopheles present, it frequently happens that, on account of their habit of concealment by day, adult mosquitoes are difficult to find, whereas their breeding places may be located readily. If the larvæ are transported to a distance they commonly do not develop further, and so, failing the specific identification of the larvæ themselves, valuable information is lost. It is therefore very desirable to know whether, and to what extent, any of the characteristics of such larvæ may safely be employed in determining their species.

Grassi was the first to direct attention to certain characters of anopheles larvæ, notably the form of the clypeal hairs, which he considered to be of value in their specific differentiation. The valuable observations of James and Christophers added greatly to the knowledge of the subject, but later studies in India and elsewhere appeared to show that these characters were not constant in the same species. James and Liston in the second edition of their monograph on "The Anopheline Mosquitoes of India," give expression to the prevalent belief that "in the larvæ of common species some of the characters vary considerably and, therefore, for purposes of identification we are not now inclined to attach very great importance to them."

In the course of a study of the anopheles mosquitoes of the Malay Peninsula, it was possible by breeding out larvæ from the eggs of known species to follow the changes in them at successive ecdyses up to maturity. The results of these observations are set forth in the present paper, and it is believed that they account for the anomalous results obtained by previous workers in this field of research, by showing that the supposed variations of any specific larva are really changes of a constant kind associated with successive phases of development. The difficulty of breeding out larvæ from the eggs laid by mosquitoes in captivity was not found to be insuperable, and it is considered that the study of such larvæ offers certain advantages over the study of the skins cast on their transformation to pupæ or of groups of larvæ from which a single species subsequently hatches out.

The larvæ of the following species were studied :—*A. albirostris*, *A. sinensis*, *A. fuliginosus*, *A. nigrans* (= *A. karwari*), *A. rossi*, and *A. ludlowi*. As the results were constant and parallel in the case of each species, it will suffice for the present purpose to give an account of only one of these, and I have selected *Anopheles albirostris*, Theobald, one of the malaria-carrying species of the Malay Peninsula.

The form and arrangement of the anterior clypeal hairs and of the posterior clypeal hairs situated on the front of the head and of the palmate hairs situated on the thorax in certain species and on a varying number of the abdominal segments, are the characters in which the most striking changes occur and these will now be described in detail.

When newly-hatched from the egg, the tiny larva of *Anopheles albirostris* is characterised as follows : The anterior clypeal hairs, the inner being long and the outer short, are simple bristles; the posterior clypeal hair is also simple and is situated behind and slightly internal to the outer anterior clypeal; the dorsal structures, some of which in full-grown larvæ become what are known as "palmate hairs," are represented by simple lanceolate leaflets; these are situated five on each side of the thorax and one on each side of the abdominal segments from the second to the seventh, and are longer on the posterior segments than on those nearer the thorax.

The anopheles larva at this stage approximates in several of its characters to mature culex larvæ and appears to indicate the mode of origin of anopheles as a differentiation from pre-existing culex forms. The lateral thoracic and abdominal hairs are simple, as in most mature forms of culex larvæ. The papilla, at the base of which the tracheæ open, is more prominent than at later stages and is semi-tubular, recalling the form of the breathing tube of culex. It should be noted that

when they leave the egg all species of anopheles larvæ are very much alike at a casual inspection, and that in several particulars they bear a close resemblance to culex larvæ.

After three or four days' growth the characters of the larva of *A. albirostris* begin to approximate to those of the mature form and are as follows :—

The anterior clypeal hairs now show traces of feathering; the posterior clypeal hair is forked and is placed nearer the mid line; instead of a single leaflet the palmate hair now becomes a whorl of lanceolate leaflets. Four of the five simple leaflets on each side of the thorax in the first stage are transformed not into rosette-like palmate hairs, but into stout feathered hairs, and one of the simple bristles on the lateral aspect of the first abdominal segment is transformed into a whorl of leaflets.

A curious feature of the larva of *Anopheles umbrosus* in regard to the palmate hairs should here be noted. Neither in the newly-hatched larva of this species nor in its more mature form have any leaf-like palmate hairs been observed, their place being taken by simple bristles and feathered hairs. The larva nevertheless assumes in the water the horizontal position common to all anopheles larvæ.

With the further growth of the larva, and at successive ecdyses, the branching of the clypeal hairs becomes more marked, and the form of the palmate hairs alters until the characteristic form and arrangement of these hairs in the mature larva are attained.

At maturity, the anterior clypeal hairs are much feathered, the posterior clypeal hair, now situated behind and near the inner anterior clypeal, consists of a very short stem, from which four or six branches arise; on the thorax and first abdominal segment the leaflets of the palmate hairs are lanceolate, and on the second to seventh abdominal segments they are jagged at the base of the terminal filament, which is long and sharply pointed.

Save in the case of a few closely-related species, of which *rossi* and *ludlowi*, *sinensis* and *barbirostris* are examples, the mature forms of larvæ of Malayan anopheles have been found to possess characteristic features which permit of their specific differentiation. So far, only the anterior and posterior clypeal and the palmate hairs have been studied in detail, and it is hoped that further study will reveal points of difference which will enable one to recognise the mature forms of all valid species. It may well be that the distinctive characters which may be observed in these development stages will form the basis for a more satisfactory grouping of adult anopheles than that which has been founded upon scale characters alone.

MULTIPLE TERATOMATA IN A GIBBON.

This animal, previously referred to in connexion with leprosy, died on the 21st January, 1913, and an autopsy was performed two hours after death.

At the site of inoculation there was a slight scar and subjacent a small nodule about the size of a millet seed could be felt. On incision, the adjacent tissues showed no inflammatory reaction.

Over the costal cartilages of the right third and fourth ribs there was a lobulated tumour the size of a walnut. The skin was freely moveable over the tumour. On removing the skin and freeing the tumour, it was found to be adherent to the costal cartilages mentioned above. The tumour felt hard. The thorax was opened. There was no extension of the tumour into the thorax. The thoracic contents were removed. A tumour the size of a bean was seen in the first left intercostal space about midway between the sternum and the spinal column. In the same intercostal space close to the vertebræ there was a tumour the size of a pea. In the first and second right intercostal space close to the vertebræ there were tumours of similar size. In the eleventh right intercostal space, close to the vertebræ there was a tumour the size of a filbert.

The abdominal contents were removed. Over the lumbar vertebræ and towards the right side there was a tumour the size of a walnut. In the left psoas muscle, near its upper fibres of origin, there was a lobulated tumour the size of a coffee bean. Each tumour on incision was found to contain hair mixed with pultaceous material. The larger tumours contained cartilaginous and bony plates.

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On microscopic examination the cystic portions, containing hair and pultaceous material, were found to be lined with stratified epithelium containing hair follicles and sebaceous glands.

Apart from the intestine, the other organs of the body appeared normal. In the ileum the Peyers patches were congested and raised. In the large intestine there were numerous minute pin-hole ulcers and granulations.

The immediate cause of death was dysentery.

Water and Water Supplies.

A considerable amount of bacteriological and chemical research has been carried out on existing and proposed water supplies.

As regards existing supplies, the work has been mainly confined to those of Taiping and Kuala Lumpur.

For the enumeration of the organisms present in water, gelatine plates do not yield satisfactory results here. Plates containing + 10 nutrient-agar have therefore been employed, and the estimations made after incubation at 37° C. for forty-eight hours.

By this method the water which is supplied to Kuala Lumpur has been found to yield, in dry weather, an average of forty-five organisms per cubic centimetre. In wet weather the average number was seventy in the same volume of water.

The presumptive test for *Bacillus coli* was positive in not less than five cubic centimetres, save once in October. On that occasion the examination was made after heavy rain, which had followed on a period of dry weather, and a positive result was obtained with one cubic centimetre.

The lactose-fermenters isolated in the dry weather during January and February were *B. cloacae*, *B. grunthal*, *B. vesiculosus*, *B. lactis aerogenes* and *B. neapolitanus*.

The method employed was that recommended by Major Clemsha, who has shown that these organisms belong to the class of coliform organisms which are of a resistant nature and not necessarily indicative of recent pollution.

The results obtained in October and November, after heavy rains, were not so satisfactory. *B. coli communis* (Escherich) and *B. coli mutabilis* (Massini) were isolated on these occasions from ten cubic centimetres of the water.

On one occasion an unsatisfactory condition of the new water supply was reported and eventually traced to the presence of illicit mining on the catchment area; this was stated to be rigidly reserved and patrolled.

An unsatisfactory condition of the filtered water supplied in Taiping was detected here, and, on investigation, proved due to inefficiency of the filters. It is of interest to note that the communication received with the sample of water stated that everything in connection with the water supply was satisfactory.

As regards projected water-supplies these have been mainly concerned with a low-lying, sparsely-populated district in Perak and a low-lying district in Selangor. In the former case the water to be employed might fairly be described as dilute sewage; in the latter case it is dilute sewage mixed with a large amount of colloidal clay.

It is proposed in both cases to employ mechanical filters in order to obtain a potable water.

The hills are for all practical purposes free from human habitations. They furnish, therefore, excellent catchment areas, the distance of which from the point of distribution can in no instance be excessive; it can certainly never approximate to the great distances which are necessary at home for the transport of potable water.

The annual rainfall exceeds one hundred inches. There is therefore no apparent reason why every part of the peninsula should not be provided with a water-supply exceeding in excellence that which can be provided in other and more densely populated tropical countries. It has been contended as regards the sparsely populated area that in no other country would a water-supply be provided, because the cost would be excessive and the revenue inadequate, but that furnishes no grounds for the provision of a water-supply the source of which is known to be unsatisfactory.

On account of the process of elutriation by which tin ore is produced the water in the rivers in practically every part of the country contains colloidal clay; the greater the amount of this material present the greater is likely to be the amount

of contamination present from human and other undesirable sources. This is well illustrated by the projected source of water-supply for a low-lying district in Selangor.

It may be that, on the grounds of expense and engineering difficulties, water-supplies from rivers cannot be brought from these sources at a point above that at which they are systematically subject to contamination, but I can conceive of no circumstances under which it is permissible in this country systematically to arrange for the conversion of dilute sewage into water for human consumption. The fascinating position which filters, mechanical and otherwise, occupy in the minds of many in this country is surprising, and it would appear to be considered that the more elaborate and complicated the process by which filtration is accomplished the more excellent must be the results. In densely-populated countries and in certain circumstances such methods may be unavoidable, but in this country they are certainly not.

It is true that dilute sewage can be treated in such a way as to render the final product potable. Courageous individuals have on occasion partaken of the filtrate from the contact-beds of a septic-tank system; but a proposal to make that system the regular source of a potable water-supply would meet with objections amply justified on grounds other than sentimental. By chemical precipitants and mechanical filters undesirable materials can to a large extent be removed from waters. This is more especially true in the case of hard waters. In those waters the lime contained forms with the added alum a precipitate which is easily got rid of. In this country there are no hard waters. The colloidal clay contained in the waters forms with the alum a jelly-like mass, which is difficult to remove and clogs the filters, thus necessitating an amount of care which must imperil their efficiency.

Every process of mechanical filtration requires constant skilled care and attention; this cannot be obtained under the conditions which prevail here.

Even granting that the major portion of the undesirable material has been removed, and undesirable portion remains, and there is the ever-present danger that through some fault this may be increased.

Already, investigations have been made on water from the hills; this work it is proposed to extend with a view to obtaining reliable information and to urge the desirability of obtaining water-supplies from the numerous excellent sources which must exist in place of from the undesirable sources to which so much attention is now being devoted.

The cultivation of amœbae.

Experiments have been carried out on the cultivation of amœbae with a view to repeating the experiments of Clegg, who claims to have cultivated the bacillus of leprosy in symbiosis with amœbae.

By the use of the alkaline nutrient agar recommended by him cultures of water amœbae have been obtained, but up to the time of writing cultures of the pathogenic amœbae have not been obtained; this would appear to confirm the findings of other investigators, who claim that the pathogenic amœbae have not been induced to lead a saprophytic existence.

Cysticercus Cellulosae.

During October several specimens of this parasite, which is of recent introduction, were received. In one instance the Sanitary Inspector found pieces of pork full of cysts being cooked in an eating-house.

Widal Reaction.

One hundred and eighteen specimens of blood-serum were examined for the presence of typhoid agglutinins.

Forty-four of the fifty-three cases in which a positive result was obtained were inmates of hospitals in Kuala Lumpur.

Wassermann Reaction.

This test was carried out in twenty-seven cases in which syphilis was suspected, or where it was considered desirable to estimate the effect of anti-syphilitic treatment.

During the first half of the period under consideration Noguchi's system was

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employed. During the past three months the method of Browning and MacKenzie was adopted, but modified by the use of an anti-human haemolytic system.

The results of the examination were as follows :—

Ten latent and doubtful cases, of which four were positive and six negative.

Ten tertiary cases, of which nine were positive and one negative.

Seven secondary cases, all of which gave positive reactions.

Chemistry.

Mr. Hill furnishes the following report :—

The total number of analyses performed during the six months was 616, which may be classified as follows :—

1. Waters	43
2. Milks	172
3. Chandu and chandu dross	62
4. Morphine	49
5. Counterfeit coins and materials	193
6. Articles examined for blood-stains	29
7. Articles examined for poisons	27
8. Liquors	32
9. Miscellaneous	9

1. *Waters.*

The systematic examination of the Taiping supply was continued. In January one sample was found to contain fine filaments in suspension, which on examination proved to be spirogyra, showing that the filter beds were out of order. Mr. Blair visited the water works and enquired into the matter. He found that one of the two filter beds in use had a broken surface allowing algae, &c., to pass through into the reservoir. The latter was found to contain spirogyra and frog-spawn.

Several samples of water were received at various times from the Langat River. It was proposed to use this source for supplying Jugra after treatment by a process of mechanical filtration. The results of analysis in every case showed that the water was badly contaminated, and it could not be said that it would be fit for drinking purposes even after the proposed treatment.

There has also been difficulty experienced in securing a satisfactory supply for Gemas. Formerly the water from a stream was used and was taken from below the point of entry of the drainage from the settlement. Chemical analysis showed this to be a polluted water. The same supply has since been treated by mechanical filtration, which has produced a great improvement. On one occasion Mr. Blair visited Gemas and took samples of the treated and untreated water. It was found that the treatment caused a diminution of albuminoid ammonia from ·017 to ·007 parts per 100,000, and of oxygen absorbed from ·25 to ·03. Also the colour was greatly improved. In spite of this great improvement in the chemical condition of the water, it cannot be pronounced safe for drinking purposes without a confirmatory bacteriological examination, owing to its previous history and the fact that the raw water is badly contaminated with sewage.

Samples from the supplies of Kajang and Pekan were also analysed.

2. *Milks.*

Of the 172 samples analysed 7 were tinned milks and the rest were fresh. Of the fresh milks 26 were found to be adulterated with water. Most of the offenders were prosecuted and fined. The majority of the samples were buffalo milk and contained a high proportion of fat.

3. *Chandu and chandu dross.*

Most of these samples were examined with a view to finding whether the chandu was of Government manufacture and whether the dross was derived from Government chandu. The dross in every case was found to be derived wholly or in part from Government chandu.

Twenty samples of chandu were found to be non-Government. Ten suspected samples contained no chandu.

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4. *Morphine.*

Of the samples examined for morphine, 33 gave positive results and 16 negative. There has been a considerable increase in the number of these samples and the majority came from the Klang district. They took various forms—powders, red-coated pills, and residues in bowls and syringes. The powders usually contained a fair proportion of milk-sugar and only 60 per cent. to 80 per cent. of morphine hydrochloride. Cinchonine hydrochloride was also frequently found mixed with the morphine powders. The milk-sugar was probably added simply as an adulterant, as it is very suitable for this purpose, being easily soluble and almost tasteless.

5. *Counterfeit coins and materials.*

One hundred and fifty-nine coins were examined and only five found to be genuine. The counterfeit coins were in all cases composed of an alloy of antimony and tin usually obtained by melting down Britannia-metal spoons imported from Germany.

In one case eight coins were received, four of which were found to be counterfeit 20-cent pieces made of Britannia metal. The other four were obviously genuine and were of standard weight. On analysis, two of them (20-cent pieces, dated 1910) were found to contain 60 per cent. silver, whereas the Legal Tender Enactment lays down 80 per cent. silver as the standard for subsidiary coins. One of the others (a 5-cent piece, dated 1910) was found to contain 58 per cent. silver and the other (a Queen's head 5-cent piece, dated 1895) just under 80 per cent. silver. In giving evidence in court, the three coins containing 60 per cent. silver and less had to be reported as not satisfying the enactment and therefore as counterfeit coins. The Senior Deputy Public Prosecutor subsequently made enquiries and found that the standard for Straits subsidiary coins was altered some years ago from 80 per cent. to 60 per cent. The Legal Tender Enactment has not been altered, consequently all the recent subsidiary coins are illegal.

The counterfeiting materials examined were chiefly Britannia-metal spoons of German manufacture, plaster of Paris moulds sometimes containing metal castings, and crucibles containing metal which had been melted.

6. *Articles examined for blood-stains.*

Eighteen of the articles gave positive results for blood and 11 negative. The articles consisted chiefly of articles of clothing and weapons such as parangs, axes, &c.

7. *Articles examined for poisons.*

Fifteen of these were viscera or stomach contents, 7 of which gave positive results. The poisons found were opium (4), alcohol, and arsenic (2).

Of the other articles examined, only one was found to be a poison, namely, chandu dross.

8. *Liquors.*

Complete analyses were made of 15 spirits and partial analyses of 9 samples of various liquors. The alcoholic strength of 4 liquors was determined for excise purposes. Most of these spirit determinations for excise purposes are now done by the Trade and Customs Department, and only specially obstinate samples such as liqueurs and other liquors rich in sugar and extract are sent here for analysis.

Four samples of toddy were analysed. The alcoholic strength, acidity, and extract were determined. None of the samples could be said to be adulterated. The alcoholic strength varied between 8·4 and 13·6 per cent. proof spirit, the extract between ·7 and 2·2 per cent., and the acidity between ·3 and ·7 per cent. acetic acid.

9. *Miscellaneous.*

These included the following :—A deposit, from the regulating gear of the power station at Ulu Gombak, was found to be iron rust.

A sample of quinine bihydrochloride, received from the Senior Medical Officer, was found to consist principally of the hydrochloride.

A sample of water from the interior of a locomotive boiler which had become badly corroded. It was found to be rich in magnesium and other chlorides, which had been concentrated from the feed-water and would account for the rapid corrosion.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

A sample of a deposit which had collected in the accumulators used for railway carriage lighting. This deposit was found to be a mixture of lead oxide, lead sulphate, and metallic lead, and had evidently become detached from the accumulator plates by vibration.

A sample of ganja or Indian hemp, the importation of which into this country is illegal.

A sample of galena from the Mines Department, which was found to be of only moderate quality.

A special investigation was undertaken with the object of working out a satisfactory method for the estimation of tin in ores for the Mines Department. The problem was to find a simple volumetric method based on the titration of the tin with standard iodine solution. The chief difficulty of the estimation was found to be in effecting a complete reduction of the tin after it had been obtained in solution. There are several methods for bringing about the reduction, but the one which was found to work most satisfactorily was that based on the employment of a coil of nickel foil. Whichever method of reduction is employed, air has to be excluded by means of a current of carbon dioxide, and the solution must be cooled in an atmosphere of this gas. The actual titration with iodine was found to work quite well and to be easy of manipulation.

H. Fraser,
Director, Institute for Medical Research,
Federated Malay States.

No. 13.

MALAY STATES.

BERIBERI IN KELANTAN.

By JOHN D. GIMLETTE, Residency Surgeon.

Beriberi is referred to in an old book, the Medico-Chirurgical Review of 1826, as a singular disease which seldom occurs at a distance exceeding sixty miles from the sea. It was thought, in 1826, to be confined to the island of Ceylon, the Malabar coast, and a tract of country about forty miles broad stretching from Madras to Ganjam. The writer, William Hamilton, Surgeon, H.E.I.C.S., observed that it was most prevalent during the decline of one monsoon and setting in of another, " when the atmosphere is completely loaded with cold, raw, damp vapours, and the vicissitudes of temperature are greater than at any other period of the year." Present day observers know that beriberi may occur at places far beyond a distance of sixty miles from the sea, and, in the East, they have been struck, not so much by the geographical limitation of the disease, as by the very high death-rate that beriberi may cause among the labouring classes. In the Malay Peninsula, imported Chinese and Javanese suffer while the indentured Tamil and the local Malay are comparatively exempt. Evidence in regard to the influence of meteorological conditions is conflicting. Recent work points to rice as a causative agent and not to any specific organism except the acidifying bacillus of Kohlbrugge.

Kelantan is a small state far beyond the geographical limitation of the old writers; it is situated on the east coast of the Malay Peninsula, in geographical position between 4° 55′ and 6° 25′ lat. N., and 101° 30′ and 102° 40′ long. E. The country is one of the three Malay States that came under British protection about three years ago. It has only been exploited by European enterprise during the last ten years. Ten years ago Kelantan Malays probably knew nothing about beriberi, because even to-day it hardly comes within the knowledge of the most sagacious of the Kelantan " bomos " or " medicine men "; these old men, as well as the " witch doctors " are mainly employed by their own people and seldom practise among newcomers. Their own people, the Malays, live comfortably on local products, their staple diet being a coarse unpolished Kelantan rice, but the diets of all newcomers have to be provided by their employers and vary in accordance with race custom, habit, and mode of life. During the decade in which this new country has been opened up, beriberi has been almost entirely confined to the new-

comers who have been employed under European supervision. The history of beriberi in Kelantan is of interest; it shows that the disease was imported and that it spread among the labouring classes who were fed upon imported polished rice, but it seems to point to the fact that the rice conveyed the disease but did not actually cause it to break out in an epidemic form.

The history commences in the interior of the State: the coast districts and Kota Bharu, the capital, with 12,000 inhabitants, have always been free from beriberi. The disease broke out among Chinese in 1904 at a gold mining camp which was badly situated in a "punch bowl formation" located in a dense jungle more than sixty miles from the sea. A British syndicate, which was soon afterwards formed into a powerful company, began operations here in 1903. It was found necessary to engage gangs of Chinese for underground mining and to import the bulk of their food. About this time, beriberi was rife in the Federated Malay States, especially among Chinese coolies engaged in similar but surface work in the tin fields of Perak, as well as among the inmates of many of the public institutions, for example, the asylums, the Pudu gaol in Selangor, and many of the Government hospitals. Some anxiety was felt by the writer, who had come from Perak, on the west coast of the Malay Peninsula, to take medical charge of the coolies in this out-of-the-way place on the east coast, as to the possibility of maintaining the existing immunity from the disease. No cases of beriberi, however, were diagnosed in 1903. The first batch of newcomers was a healthy one; the Chinamen were fed upon imported Rangoon rice, which is a polished rice, but not a highly polished variety. They preferred it on account of the clean, attractive appearance, the sweet smell on boiling, and the saving of time in cooking, to any kind of unpolished rice which, as was afterwards proved to science, would have been so much more wholesome for them. Beriberi was suspected in the interior in 1904, but there were only eight probable cases, with two deaths; four of these came into hospital from the mines. The approximate Chinese labour force in 1903-1904 was about 250 men. In 1905, there were 105 cases of beriberi, with 17 deaths, among the miners. The labour force was now about 400 Chinese, and every possible precaution was taken by the mine management to prevent the spread of the disease. The Rangoon rice was thought to be harmful, and it was assumed by the writer in 1905 that the illness was caused by the consumption of this rice because it had become mouldy in the bags owing to damp, unavoidable delay, and difficulty in river transport. The hypothesis was based on the teaching of Mr. Leonard Braddon, who, in November, 1900, at the Second Annual Conference of Medical Officers of the Federated Malay States, held in Kuala Lumpur, first propounded the "rice theory" of beriberi in this part of the world and whose genius led to the subsequent development of his theory into practice in and beyond British Malaya.

The company was recommended to mill locally grown Kelantan rice on the spot, but it was difficult to carry this out to supply a large demand. There was no established market in the vicinity of the mines where Kelantan rice could be bought wholesale, and it was found to go mouldy when collected and stored in any quantity. Underground operations were suspended early in 1906; many (but not all) of the Chinese returned to Singapore. The interior of the State was reported to be exempt from beriberi in 1906, and this is singular, because it is unreasonable to suppose that the coolies who remained had acquired an immunity. One attack does not protect against subsequent attacks of beriberi. I was in constant charge of the coolies until July, 1906; it seemed that the disease died out of its own accord. The health was then good, and an attempt was made to preserve it by bringing Kelantan Malay rice into general use. The sale of polished rice, however, was not prohibited in the interior, and being a very popular sale, it was imported by native contractors and small shopkeepers although no longer ordered from Singapore by the Company. New Chinese coolies, as well as some Javanese, were next employed for the purpose of planting rubber, and early in 1907 beriberi again broke out on the first large estate. The average number of imported coolies in 1907 was 303·5; beriberi prevailed among them for the next three years. I was again in charge in July, 1907. Thirty-nine Chinese coolies and two Javanese came into hospital from the estate, and out of these twelve Chinese and one Javanese died. Ten cases remained in the wards at the end of 1907, and nine of these were dead before

the end of January, 1908. The situation was grave; seven coolies who were in hospital for ulcers were attacked with beri-beri, and they all died. There were eleven deaths in the wards in January, 1908, and thirteen new cases were admitted from the estate. The bulk of the hospital diets consisted of Rangoon rice, which was well cooked in the ordinary way and not steamed. An enquiry was made into all the rice and food supplies; the diets were found lacking in variety and mouldy Rangoon rice was found again, but it was not present to the extent that had occurred at the mines in 1905. The hospital wards were well cleaned, painted, whitewashed and thoroughly swabbed with perchloride or mercury, 1 in 500; this appeared to have a good effect. In February there were only five new cases, including one Javanese, with no deaths. In March there were only two new cases, one Chinese and one Javanese, with one death. It was found necessary by the Company to import rice again, but this was not done until the last half of the year 1908. Siam rice No. 2 was chosen. Siam rice No. 2 is a more highly polished rice than Rangoon rice, with a higher incidence to beriberi in fowls and poorer in phosphorus pentoxide, which is a chemical element in the protected quality of rice, as is proved by Fraser and Stanton. There were no further cases, however, on the estate until December, when there were four, with two deaths. Siam rice No. 2 was imported throughout the first half of 1909 up till September; there were 36 cases of beriberi and 17 deaths, with nine more deaths due to this condition among hospital cases brought forward from the previous year. Of the new admission, 13 occurred during the months of January, February, and March, and 15 in December, with only eight during the other months of the year. In 1910, no Siam rice was imported by the Company; the labour force was now about 525 resident coolies. The only new rice brought in was a supply of parboiled rice for the use of a few indentured Tamils. Parboiled rice is rich in phosphorus and no beriberi occurred among the Tamils; but among the Chinese there were 14 cases remaining from the previous year, and out of these 7 died in 1910. There was also another batch of 14 cases, with 5 deaths, which are not shown in the return of cases attached. These particular coolies came from the camp of a Chinese contractor in an outlying estate; he was found to be feeding about 150 of them on a very poor rice diet much lacking in proper variety, more especially as regards vegetables and pork. With one exception, all the new admissions in January, 1910, were traced to these coolie lines. They had been established about the middle of 1909, and had been responsible for most of the cases admitted in December of that year. It looked like a focus of the disease and steps were taken to stamp it out; the coolies were all sent away and the camp was broken up. The interior again seemed free from beriberi. From now onwards only local-bought rice was supplied by the Company, with the exception of occasional small supplies of polished rice made necessary by temporary shortage in the supply of Kelantan rice. At the same time the diets of all the Chinese coolies on the plantation were improved so as to approximate them to the more varied diets of the richer Chinese residents. No further cases of beriberi have been registered in the interior of the State since April, 1910. I am indebted to Dr. A. G. H. Smart, who was in charge of the coolies from the end of 1908 to early in 1912, for the notes covering this period. In reviewing the work done in the interior during the year 1911, he remarks : " In view of the prevalence of beriberi in previous years and the high death rates produced, it is a striking fact that, out of 2,256 admissions to hospital during 1911, no case of beriberi was noticed."

The coast districts of Kelantan, which are mainly agricultural areas, and Kota Bharu, the capital, have, as stated above, been free from beriberi. Kota Bharu is provided with a native gaol which accommodates, on an average, about 160 prisoners, who are nearly all Malays. The gaol was built in 1907 under Siamese administration and has since come under British control. The staple diet is Kelantan rice, which has been in use since 1907; locally grown paddy is pounded by hand and foot and thus roughly husked; it is then winnowed by primitive methods. The institution has been free from beriberi since it was founded. The same staple diet has always been in use in the State hospital at Kota Bharu. During the time it has been under British control only a few solitary cases of beriberi from the interior have been admitted. In Kelantan the disease seems, from the attached return, to have been more prevalent after the heavy rainfalls. The relative mortality can be roughly worked out because the two seasons common to this part of the world

are definitely divided when compared with those of the Federated Malay States. There is always a period of very wet and stormy weather in Kelantan at the end and beginning of each calendar year. A hot, moist climate with two monsoon periods: a more rainy or north-east monsoon period, from October to March, and a drier or south-west monsoon period, from April to September, is the rule. A peculiar equability of temperature is more or less constant during each period; the average approximates 86·0° F., with about 10 inches of rain as an average monthly total; extremes, in both cases, occur in either period, but there is no very marked variation in the maximum and minimum temperatures. This natural combination of heat and moisture is very favourable to the development of diseases which are due to the mechanical action of vegetable fungi or moulds. They are most common during the wet weather. Everyday examples are found in Kelantan in various forms of ringworm, which are very common, especially " dhobie itch " or crutch ringworm. The moulds which cause these affections seem to attack the skin through moist clothing much in the same way as moulds attack rice through the medium of damp sacking. In 1905, when beriberi prevailed at the mines during the south-west monsoon period, it was found that the rice in use at the time was very mouldy. It had been stacked in bags previously and the bags had not been interchanged. In the light of recent research, it seems reasonable to suppose that the moulds which formed so readily in Kelantan in 1905 and in 1907 on imported rice, when beriberi was prevalent, were prejudicial by destroying the pericarp of the grain in a mechanical way, *i.e.*, without chemical change. Fraser and Stanton have proved by scientific methods of research that the loss of the sub-pericarpal layer in rice grain renders it unsafe, and have worked out the incidence of beriberi in fowls to polished rices which have been made harmful by the mechanical process of milling and polishing. The most highly polished varieties are the most hurtful It seems likely that, if the cells of the aleurone layer of Rangoon rice, already deprived in some measure of phosphorus by milling, were filled by the hyphæ of a fungus, that the incidence of this moderately polished rice would be raised, and that, if the pericarp of any rice grain was destroyed by moulds, that the grain might become as harmful as, or more hurtful than, any kind of polished rice.

Kelantan rice is attacked very quickly by moulds; during the wet weather it spoils within three or four days if the rice is damp and entirely neglected. It is for this reason, I think, that Malays, who are naturally indolent, do not attempt to warehouse their rice in sacks; they prefer to go to the personal exertion of pounding paddy in small quantities at a time and so keep the rice fresh, clean and dry, and in this way, perhaps, preserve it from the risk of acquiring any incidence to beriberi. It follows that hygiene, when applied to the imported food supplies of labourers segregated in numbers in lonely places, may be of greater benefit than legislation. In Kelantan beriberi was, so it seems, imported as a new disease to the Malays, and so long as it existed it seemed to spread by means of a favourable medium—evidently imported rice—but it does not seem to have been brought in by the polished rice that was first imported. The elaborate polishing of rice by means of modern machinery can hardly have been known to William Hamilton and the older writers on beriberi who described the disease so long ago as 1782 from the Carnatic district of India. There does not seem to be any real reason for supposing that these observers confounded beriberi with anchylostomiasis, as has been suggested.

The pericarp of the rice grain seems to be a very great and natural protection of rice against some specific poison which is resistant to heat.

The review of the history of beriberi in Kelantan as it occurred during the last ten years seems to support the views held by those observers who regard rice only as a vehicle of infection among human beings and not as a causative agent.

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Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

3. Braddon. "Medical Archives of the Fed. Malay States," p. 26. Kuala Lumpur, Selangor Government Printing Office, 1901.
4. Gimlette. "Journal of Tropical Medicine." September 1, 1906.
5. Fraser and Stanton. "Studies from the Institute for Medical Research." Fed. Malay States. No. 12, 1911.
6. Dick. "Duncan's Edin. Medical Commentaries." Vol. X., p. 207.

JOHN D. GIMLETTE,
Residency Surgeon, Kelantan.

Kota Bharu,
Kelantan.
February 16th, 1913.

A Return showing the new cases of Beriberi, Deaths, and Monthly Rainfall on Mines and Plantations.

Kelantan, 1904-1910.

Year.	1904.			1905.			1906.			1907.			1908.			1909.			1910.		
Month.	New cases.	Deaths.	Rainfall in inches.	New cases.	Deaths.	Rainfall in inches.	New cases.	Deaths.	Rainfall in inches.	New cases.	Deaths.	Rainfall in inches.	New cases.	Deaths.	Rainfall in inches.	New cases.	Deaths.	Rainfall in inches.	New cases.	Deaths.	Rainfall in inches.
January	1	1	7·40	6	5	5·22	—	—	28·48	6	—	8·32	13	12	9·29	3	2	6·46	6	7	11·28
February	7	1	·04	—	1	7·45	—	—	2·54	10	7	3·44	5	5	8·94	6	8	8·80	—	3	14·73
March ...	—	—	1·57	2	—	3·39	—	—	2·40	6	—	1·80	2	5	5·74	4	4	1·43	1	—	5·08
April ...	—	—	6·18	1	—	3·03	—	—	12·08	4	3	2·55	—	1	2·40	2	2	2·19	—	—	6·78
May ...	—	—	4·72	10	1	8·80	—	—	5·17	3	1	7·14	—	—	9·93	1	1	8·00	—	—	4·96
June ...	—	—	5·89	18	—	13·60	—	—	3·01	—	—	6·74	—	1	7·28	1	1	5·88	—	—	3·88
July ...	—	—	11·13	28	6	7·06	—	—	11·40	—	—	7·63	—	—	7·07	3	3	3·73	—	—	3·24
August ...	—	—	6·39	10	1	12·36	—	—	7·96	—	—	2·44	—	—	7·90	—	1	6·62	—	—	9·63
September	—	—	6·53	4	—	9·04	—	—	12·08	—	—	13·77	—	—	10·52	—	—	4·63	—	—	7·16
October ...	—	—	12·31	5	—	15·79	—	—	10·28	—	—	11·79	—	—	9·22	—	—	8·48	—	—	13·20
November	—	—	13·06	9	2	17·42	—	—	12·77	3	—	13·72	—	—	11·03	1	—	9·90	—	—	9·97
December	—	—	2022	12	1	10·97	—	—	29·76	9	2	35·76	4	2	6·80	15	4	7·51	—	—	24·23
Total...	8	2	95·44	105	17	114·13	—	—	137·93	41	13	115·10	24	26	96·12	36	26	73·63	7	10	114·14

No. 14.

SIERRA LEONE.

The GOVERNOR to the SECRETARY OF STATE.

(Received 25 August, 1913.)

Sir, Government House, Sierra Leone, 11th August, 1913.

With reference to your Circular despatch of the 19th March last,* relative to the Report of the Advisory Committee for the Tropical Diseases Research Fund for the year 1912, I have the honour to transmit to you herewith, for the information of the Advisory Committee, the following reports :—

(1) Reports by Dr. J. C. Murphy, Medical Officer, on the splenic index (Freetown), and on vaccination results (Freetown).
(2) Report by Dr. J. M'Conaghy, Medical Officer, on the splenic index (Karene District).
(3) Report by Dr. H. E. Arbuckle, Medical Officer, on the splenic index (Bo and Kennema).
(4) Report by Dr. J. W. Collett, Senior Medical Officer, on "dried vaccine lymph" (Freetown and Protectorate).
(5) Report from Dr. J. M'Conaghy, Medical Officer, on a case of anæsthetic leprosy (Batkanu).
(6) Report by Dr. J. Y. Wood, Medical Officer, on goitre (Koinadugu District).
(7) Report by Dr. J. Y. Wood, Medical Officer, on two cases of trypanosomiasis (Koinadugu District).

* Not printed.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

(8) Report by Dr. J. M'Conaghy, Medical Officer, on four cases of "bayloo" (Karene District).

I have, &c.,
E. M. MEREWETHER,
Governor.

Enclosure 1 in No. 14.

J. C. Murphy, Medical Officer, to the Principal Medical Officer.

Sir,

Freetown, August 7, 1912.

I have the honour to forward to you the result of examination of spleens in the Freetown District. With the exception of 16 all the examinations were made in the latter end of the month of July (the 16 exceptions early in August). With three exceptions all the children were over 3 years and under 13. In trying to make sub-divisions between these ages I found it quite impossible to get reliable information, and that any arbitrary sub-division made by guesswork would cause confusion only. Undoubtedly there was a larger percentage affected in those who appeared to be of six years and under. The same number of children were examined as in 1911, and the same method adopted. I probably had more time at my disposal. Palpation only used. I found, as anticipated by medical officer making examination in 1911, a larger proportion affected. I attribute this to the time available for examination and possibly the difference in the seasonal incidence. The same classification for size of spleen was adopted, *i.e.*—

1 = spleen that could not be palpated.
2 = ,, ,, be palpated from 1-2″ below costal margin.
3 = ,, ,, ,, ,, 2-3″ ,, ,,
4 = Ague cake.

As far as possible I endeavoured not to take too many schools in the same locality; but to take one at least in every district, so as to show the average for whole town.

I have, &c.,
J. C. Murphy,
Medical Officer.

Splenic Index.

No. of Schools Examined.	Name of School, &c.	Total of each School.	Girls.	Boys.	No. affected.		Not affected.		Extent affected. (2)		(3)		(4)	
					Girls.	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.	Boys.	Girls.	Boys.
3	Cathedral School.	247	137	110	32	23	105	87	28	18	4	3	—	2
2	Holy Trinity...	164	71	93	19	39	52	54	19	28	—	5	—	6
3	St. Anthony's....	123	29	94	3	32	26	62	3	28	—	4	—	—
3	Roman Catholic Schools.	99	54	45	15	13	39	31	14	12	1	2	—	—
2	Brookfields ...	118	44	74	5	13	39	61	5	11	—	2	—	—
2	Buxton's School	149	61	88	9	20	52	68	8	18	1	1	—	1
2	Pademba Road	68	29	39	4	6	25	33	2	3	1	2	1	1
	Out Patient Colonial Hospital.	16	5	11	—	2	5	9	—	1	—	1	—	—
2	Jehovah School	49	26	23	5	9	21	14	5	7	—	2	—	—
2	Bathurst Street	117	54	63	11	15	43	48	10	14	1	1	—	—
Totals 21	—	1,150	510	640	103	172	407	467	94	140	8	23	1	10

J. C. Murphy,
Medical Officer.

Freetown,
August 6th, 1912.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

J. C. Murphy, Medical Officer, to the Principal Medical Officer.

Freetown, August 7, 1912.

I have the honour to forward to you the following information *re* vaccination in the Freetown schools mentioned below :—

Name of School, Street, &c.	No. Examined.	Successful.	Unsuccessful.	Not Vaccinated.
Cathedral School, Howe Street ...	236	135	17	84
Holy Trinity, Fourah Bay Road ...	119	108	26	65
Ascension Town Roman Catholic Schools.	173	129	19	25
Brookfields	117	79	9	29
Howe Street Roman Catholic Schools	210	158	16	36
Jehovah, Waterloo	110	84	10	16
Bathurst Street School	126	68	9	49
Buxton School, Charles Street ...	157	121	13	23
Pademba Road School	56	44	4	8
Total	1,334	926	113	335

I have, &c.,
J. C. Murphy,
Medical Officer.

Enclosure 2 in No. 14.

The Medical Officer, Batkanu, to the Principal Medical Officer.

Freetown, August 7, 1912.

I have the honour to forward the result of a splenic examination made by me in this district. All the children examined were, as far as I could judge, under 12 years of age. All were examined while lying down, and by percussion as well as palpation. I am stating the number of children examined, with the percentage according to degree of enlargement; and a list of the towns, with the number of children examined in each and the number of spleen enlarged.

I have, &c.,
J. M'Conaghy.

Result of Splenic Examination made in the Karene District, January to April, 1912.

1. Total number of children examined, 470.
   Percentage with enlarged spleen, 42·97 per cent.
2. Analysis of percentage according to degree of enlargement :—
   Spleen just palpable on deep inspiration, 9·574 per cent.

Spleen palpable	1	finger's breath	below	costal border,	3·617	per cent.
,,	2	,,	,,	,,	10·638	,,
,,	3	,,	,,	,,	15·53	,,
,,	4	,,	,,	,,	3·4	,,
,,	5	,,	,,	,,	0·212	,,

List of towns, showing the number of children examined in each, and the number with enlarged spleen :—

Town.	*No. of children examined.*	*No. with spleen enlarged.*
Rosos	12	4
Makumri	12	6
Kamalo	23	8
Kabararbara	10	3
Myoban	11	5
Kagbanbama	32	9

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Town.	*No. of children examined.*	*No. with spleen enlarged.*
Romani	13	7
Yelasandu	32	16
Mangai	12	8
Kamba	10	4
Kambia	18	9
Kawula	16	11
Bharmoi	19	8
Gbalanduja	14	10
Conteh	6	3
Mankinni (Majoki)	14	7
Magbwele	11	2
Manyaka	7	4
Mabwia	11	4
Bybunda	14	3
Makarri	39	21
Kunsa	19	5
Mankinni (Bomballi)	14	6
Mabole	13	4
Mapaki	25	14
Massoune	22	7
Marra	25	6
Senduga	14	8

J. M'Conaghy,
Medical Officer.

Batkanu,
June 27th, 1912.

Enclosure 3 in No. 14.

Medical Officer, Bo, to the Honourable Principal Medical Officer.

I have the honour to forward you the splenic indices for Bo and Kennema in accordance with Circular, No. 22/12. The index for Bo represents the schools of Bo mainly, as I have experienced great difficulty in getting the town's children, although I have been four times to the chief about it. I have used Ross's method.

Bo.

Non-palpable.	Palpable.	Total.	Index.
108	60	168	35·77

Age periods.	Non-palpable.	3.	6.	9.	Total.
0–5	—	3	3	2	8
6–10	28	14	13	6	61
11–	80	15	4	—	99
Total ...	108	32	20	8	168

Kennema.

Non-palpable.	Palpable.	Total.	Index.
20	50	70	71·4

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Age periods.	Non-palpable.	3.	6.	9.	Total.
0–5	6	12	10	1	29
6–10	13	17	7	—	37
11–	1	3	—	—	4
Totals ...	20	32	17	1	70

H. E. Arbuckle.

September 21st, 1912.

Enclosure 4 in No. 14.

The Colonial Hospital,
Freetown, Sierra Leone, April 10th, 1913.

I have the honour to submit the report called for by the Secretary of State on the trial of "dried vaccine lymph" in the Colony and Protectorate of Sierra Leone, and to compare these results with those accruing from the use of "lanolinated calf lymph" in this climate.

2. Supplies of both these preparations of vaccine lymph were forwarded, in the routine of distribution, to the medical officers in charge of the following districts:—Northern Sherbro, Sherbro, Karene, Koinadugu, and the railway district. A supply was also sent to the native dispenser at Sumbuyah, and it was intimated to those officers that a report would be called for in due course.

3. In the newly-opened Northern Sherbro District the following towns were visited (and persons vaccinated):—Bandajuma, Pujehun, Imperre, Gendema, and Shengey. In the town of Bonthe, in Sherbro, the experiment with dried lymph was tried. In the railway district, Bo and Kennema and Daru were visited, and persons were vaccinated. Kaballa, in the Koinadugu District, and Moyamba, in the Ronietta District, were also supplied with dried lymph, and investigations with it were instituted.

4. The results of these investigations are tabulated for easy reference as follows:—

Tabulation of Results of Experiments with Dried Lymph in Sierra Leone during 1913.

Date.	District.	Town.	Number Vaccinated.	Number Successful.	Unsuccessful.	Per cent. of Success.	Lymph used.	Remarks.
						Per cent.		
May and June, 1912.	Northern Sherbro	Bandajuma	38	32	6	84·2	Dried	
		„	67	61	5	91·2	Lanolinated	
May 15th ...	„	Pujehun	22	22	—	100·	„	
May 15th ...	„	Barma	14	12	2	85·7	„	
July	„	Puje	46	46	—	100·	„	
July	„	„	71	71	—	100·	Dried	
May 23rd ...	„	Shengey	14	12	2	85·7	„	
May 24th ...	„	„	14	14	—	100·	Lanolinated	
May 24th ...	„	„	9	8	1	88·8	Dried	
June 10th ...	„	„	15	12	3	80·	„	
June 6th ...	„	Gendema	17	13	4	65·3	Lanolinated	
June 24th ...	„	Imperre	65	64	1	98·4	„	
June 24th ...	„	„	41	36	5	87·8	Dried	
June 7th ...	Railway District	Bo	10	10	—	100·	„	Lymph mixed c glycerine.
June 7th ...	„	„	10	9	1	90·	„	Lymph mixed c water.
August... ...	„	Kenema	115	109	6	95·4	„	
September ...	„	Daru	72	50	22	69·4	,	
September ...	Karene	Batkanu	79	55	24	69·6	„	
July 6th ...	„	„	102	85	17	83·3	„	
September ...	Sherbro	Bonthe	39	38	1	97·4	„	
September 23rd	Koinadugu	Kaballa	66	19	47	28·7	„	
September ...	„	„	32	19	13	59·3	„	
September 23rd	Ronietta	Moyamba	15	15	—	100·	„	
August... ...		Sumbuyah	22	20	2		„	

5. A consideration of the foregoing table will show that both these preparations of vaccine are very active, and give very satisfactory results; they carry well and retain activity for a considerable time in this climate equally. The preponderance of preference on the part of the medical officers is, however, for lanolinated calf lymph.

6. The disadvantages claimed by them for dried lymph are that the entire quantity contained in the hermetically-sealed glass tubes has to be utilised at once when the tube is broken in order to ensure the greatest activity of the lymph, a measure that is not always practicable when less than twelve persons can be collected together for vaccination, and that the manipulation necessary for dried lymph is more complicated and not so easy of performance as it is with the lanolinated calf lymph. Dried lymph has to be carefully rubbed up with pure glycerine before it can be successfully used; it does not mix easily with water. Lanolinated lymph is put up in small collapsible metal tubes with screw caps. With this preparation there is very much less waste.

7. It is said that although the activity of the dried variety is high, inasmuch as the percentages show, the individual reaction in each vasicle appears to be somewhat greater with the lanolinated variety of vaccine lymph.

8. The price of each kind of preparation is the same, viz., 5s. per glass or metal tube.

9. Reviewing the situation, I am inclined to favour the use of the lanolinated calf lymph, because it is apparently quite as, if not more, reliable than dried lymph, it is very much easier to manipulate, it goes farther, and is just as cheap.

J. W. Collett,
Acting Principal Medical Officer.

The Honourable
the Colonial Secretary,
Sierra Leone.

Enclosure 5 in No. 14.

The Medical Officer, Batkanu, to the Principal Medical Officer.

Sir,

I have the honour to report a case of anæsthetic leprosy, first seen by me at Batkanu on June 30th, 1912.

The patient is a man of about fifty years of age. He says that he has been ill for over six years.

There is a large anæsthetic patch over the left side of the chest, a smaller one over the left iliac region, and three on the back.

There are also several other patches on the legs and arms. The phalanges of both hands and feet are absorbed, but most of the nails are left intact. The ulnar nerve is thickened.

I examined films taken from the anæsthetic patches, the edges of the anæsthetic patches, and the nasal mucosa, but did not find any bacilli lepræ.

The clinical symptoms, however, were typical of leprosy.

I have, &c.,
J. McConaghy.

Batkanu,
July 21st, 1912.

Enclosure 6 in No. 14.

The District Medical Officer, Koinadugu District, to the Principal Medical Officer.

Sir,

Kaballa, July 6, 1912.

I have the honour to report as follows:—Having noticed the extreme prevalence of goitre in this district, I took notes of every case met with during the six months, January to June, 1912. In all I saw two hundred and fifty-seven cases (257).

Of these 83 stated their people were not affected.
35 ,, fathers were affected.
36 ,, mothers were affected.
4 ,, brothers and sisters were affected.
No details as to family could be obtained from 99.

Ages.—All ages are affected, but the majority are between 18 and 36 years of age. Enlarged thyroids are common among small children (not included here unless very large), but the people regard this as merely a fat neck, a sign of beauty.

Sex.—Both sexes are fairly equally affected.

Tribes.—Commonest among the Korankos, who take least care of their water-supply. The Yalunkas are less affected, and the Limbas very much less. Still it is fairly widely scattered in this district. The number, 257, may seem a small one for such a very large district during six months, but I would point out that the population is very small, large tracts being thinly inhabited or even uninhabited. Indeed, I understand the whole hut tax collected in the District only amounts to about £5,000.

Again, these numbers include only cases which have come under my own eye, and during the last two or three months I have seen only a small number of the people on patrol, the majority being engaged on their farms. I only saw a few of the towns in each part when on patrol, and at any time only a small proportion of the inhabitants.

Etiology.—The people themselves do not regard goitre as worth troubling about, consequently, practically none ever come to the dispensary for treatment. In a few places it is regarded as hereditary, but the majority ascribe it to something swallowed in the water.

In Kruto, where it struck one as being extremely common, I found the latrine bush was situated on sloping ground on both banks of the stream from which the people obtained their water-supply. I have no doubt that if proper latrine trenches were adopted by the people it would gradually die out, but meantime, following McCarrison's investigations in India, I had intended trying treatment with beta-naphthol with iodine painting. This, however, I must postpone at present.

I have, &c.,
John Y. Wood.

Enclosure 7 in No. 14.

The District Medical Officer, Kaballa, Koinadugu District, to the Principal Medical Officer, Freetown.

Sir,

I have the honour to report to you two cases of trypanosomiasis, as follows:—When on patrol with Dr. Simpson, the Colonial Office Entomologist, at Kamatoto (or Kamaytoto), on April 16th, 1912, the headman, during a discussion on the native names of flies and diseases, volunteered the statement that he had three cases of "sleeping sickness" in the village. Two were examined, the third being absent in a distant village at the time.

Case 1.—A woman, age 18 to 20, showed symptoms thus:—

Temperature.—101.

Pulse.—102.

Body.—Not emaciated, but gave impression of being œdematous; no pitting on pressure.

Skin.—Dull, with peculiar greyish or ashy tinge.

Muscles.—Very tender, both on body and limbs, and constant excessive trembling of tongue and limbs.

Glands.—Enlarged and palpable, but not larger than a small pea all over neck, some in strings, which felt like nodulated rubber cords, unfortunately, all too tender to permit of puncture.

Eyes.—Heavy and dull.

Spleen and Liver.—Not enlarged nor tender, but lower part of abdomen very tender.

Heart.—Soft and diffuse apex sounds.

Respirations.—Hurried, and patient unable to suppress breathing at all to permit heart sounds to be heard more clearly.

Tongue.—Flabby.

Gait.—Peculiar, as if co-ordination were affected.

Appetite.—Very slight, the chief volunteering that patient sometimes falls asleep in act of taking food.

Patient sleeps most of the time and sweats constantly. Answers questions clearly but slowly; states that two years ago abortion occurred at three months, illness began about a year ago with fever, but no fever present now, and menstruation ceased then; has grown fatter since, although taking very little food. Belongs to Mandingo tribe. Two blood films were taken, and were afterwards stained with Leishman. On an exhaustive examination of these films no trypanosomes were found, but extreme eosinophilia present.

Case 2.—Man, age about 40.

Temperature.—98·8.

Pulse.—100, very soft.

Body.—Thin and somewhat emaciated.

Muscles.—Not tender, but tremors present all over, and patient unable to stand for more than five minutes.

Glands.—A few enlarged in middle and posterior triangles of neck, one on left side the size of a large pea, but in a different [? difficult] situation for puncture.

Eyes.—Heavy and puffy.

Spleen.—Much enlarged, not tender.

Liver.—Not enlarged nor tender.

Heart.—Very peculiar. Apex diffuse and blurred, but curious snapping second sound in pulmonary area, while aortic sound was clear, though soft.

Respirations.—Hurried, and unable to suppress for auscultation.

Tongue.—Large, flabby, and heavily coated.

Gait.—Peculiar and unsteady, but very noticeable.

Appetite.—Poor.

Blood.—Extremely fluid, and gave impression of being very anæmic. In two films no trypanosomes found, but a fair amount of eosinophilia.

Patient complains confusedly and indefinitely of pains in the back, and is unable to give clear answers, speaking very confusedly and thickly. Chief states that he sleeps constantly, and is steadily wasting. He has two wives and five children, the youngest about nine years of age. Illness supposed to have begun a few months ago. Towards end of examination patient began [? to answer] more clearly. The chief also reported that their cattle, recently brought from other villages, were placed in a warri in a temporary large clearing near a heavily-wooded stream. They were attacked by clouds of small black flies slightly larger than *Glossina palpalis*, but not one of the flies shown him by Dr. Simpson. These flies disappeared during the dry season. In October (end of rainy season) the cattle began to die: "fly sickness," some with "wasting" others with swelling of the heart. This continued up till January, one man losing over one hundred, another eighty-eight. In January, when the District Commissioner visited the village, he showed him one dead and two dying. Practically all their cattle died, but no other animals. Specimens of *Glossina palpalis* were discovered near the village.

I am forwarding a copy of this report to the Director of the Sleeping Sickness Bureau.

I have, &c.,
John Y. Wood.

May 10th, 1912.

Enclosure 8 in No. 14.

The Medical Officer, Batkanu, to the Principal Medical Officer.

Sir,

I have the honour to forward you a report on three cases of "bayloo" (known among the Timinis as "bonke").

The first case I saw was an infant in arms, who cried during the examination;

in this case I am unable to send a full report. I had an opportunity of examining the other two cases in some detail. In both of these cases the liver was enlarged. In one of them jaundice was absent when seen by me, and, according to the patient's account, does not appear to have been present at any period of the illness. All the patients had arrived at a late stage of the illness when seen by me. I therefore am unable to give a description of the early stages of attack from having personally seen them.

Case 1.—At Mankini (Bombali Chiefdom), on March 10th, 1912. Patient was an infant in arms.

History.—Illness began about three weeks previous to above date, with fever in the evenings and vomiting. This was followed in a few days by yellowness of the eyes and "red" urine.

When seen by me there was light jaundice. I was unable to get a specimen of urine. The blood contained no parasites.

Case 2.—Seen at Mabole, March 11th, 1912. Patient is a boy about 14 years old.

History.—Had been ill for two weeks previous to above date. Vomited slightly at beginning of attack, and felt feverish. Urine was reddish in colour. Had severe pains in back and thighs.

Eyes.—Had slight yellow tinge. Pulse, 86. Temperature, 99·0 F. (in mouth).

Tongue.—Narrow and pointed; red at tip and edges; slightly furred in middle.

Liver.—Enlarged; edge can be felt about an inch below lower costal margin; is rounded.

Other organs.—Normal.

Urine.—High coloured.

Sp. Gr.—1,021.

Reaction.—Alkaline.

Albumen.—Absent.

Sugar.—Absent.

Blood.—No parasites.

Case 3.—At Massabong, March 14th, 1912. Patient is a man of 30 years of age.

History.—Illness began about three weeks previous to above date. Patient states that at first he had severe pains in back and legs, and severe headache; had fever every night, and vomited everything he ate. Urine was bright red in colour. Temperature, 99° F. (in mouth). Pulse, 100.

Jaundice was not present, and patient states that he was not jaundiced at any period of his illness.

Tongue.—Small, pointed, covered with white fur at posterior, two-thirds; red at tip.

Liver.—Slightly enlarged.

Other organs.—Normal.

Urine.—Colour normal.

Sp. Gr.—1,040.

Reaction.—Acid.

Albumen.—Absent.

Sugar.—Absent.

Blood.—No parasites.

I have, &c.,
J. McConaghy.

Batkanu,
March 31st, 1912.

The Medical Officer, Batkanu, to the Principal Medical Officer.

Sir,

I have the honour to forward the following report on a case of "bonke" seen by me in this district at Robanka, on July 27th, 1912.

On that date the patient had been ill for a month, so that all acute symptoms had passed when he was seen by me.

I forward the result of my examination of the patient, and a history of his illness previous to the time at which I saw him. It is, however, very difficult to get a really reliable history from natives.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

The patient was a boy of fourteen years, Mendi by name. The illness began with pain in the legs and back, fever, and vomiting. The vomit was described as "red." The pain in limbs and back was felt for ten days before the eyes got "red."

He vomited for four days before the eyes became "red." I was unable to get any history of the date of onset of the fever.

There was no pain in the abdomen; he is said to have passed "red" urine.

Examination.—The conjunctivæ were jaundiced, and the nails yellow; tongue slightly furred all over; temperature 99° F. in mouth; pulse, 80. The spleen was enlarged (could be felt about three fingers' breadth below lower costal margin). The other organs were normal. Urine was free from albumen, and of normal colour. There was no epigastric or other abdominal tenderness.

I have, &c.,
J. McConaghy.

Batkanu,
August 24th, 1912.

No. 15.

TRINIDAD.

The GOVERNOR to the SECRETARY OF STATE.

(Received 29 October, 1913.)

Sir, Government House, 3rd October, 1913.

I have the honour to forward, for your information, a copy of a report by the Medical Superintendent of the Leper Asylum with reference to the discharge of seven inmates of that institution, three of whom—cases Nos. 1, 2, and 5—are believed to be cured. In two other cases—Nos. 6 and 7—the Superintendent states that there has been an arrest of the disease; and in cases Nos. 3 and 4 there was some doubt whether the patients had suffered from leprosy.

The successful results obtained from the treatment of the disease with nastin, chaulmoogra, and antileprol, which are described by Dr. de Verteuil, may be of interest to similar institutions in other Colonies.

I have, &c.,
GEORGE R. LE HUNTE,
Governor.

Enclosure in No. 15.

Report by the Medical Superintendent of the Leper Asylum.

Sir, Trinidad, Leper Asylum, 18th September, 1913.

With reference to your minute paper of 2nd September, 1913, No. 1889, conveying the demand of His Excellency the Acting Governor for more detailed information regarding the cure and discharge of some inmates from the Leper Asylum, I have the honour to submit the following facts relative to each of the patients discharged :—

1. *P. Blackman* :—Aged 22, M., Ward No. II. Admitted on the 11th March, 1907, suffering from tubercular leprosy. Was first treated by my predecessor, Dr. Read, with chaulmoogra with some benefit, as I notice on his card the following note :—"Has been taking chaulmoogra for two years, and it has done him much good." When I assumed office, in October, 1910, I found P. Blackman in a fair way of improvement, and a patient who was always ready to undergo any treatment if it offered any fair prospect of cure. I may here state that leper patients of that description are rather rare. I took a particular interest in his case, owing to his willingness to submit to treatment. After taking a large amount of chaulmoogra and antileprol (which is a purified chaulmoogra and more palatable), I injected him twice with "606" on 19th February, 1911, and 14th April, 1911. He was subse-

quently injected once weekly with nastin B. 2, and received 32 injections. During that time he continued taking chaulmoogra and antileprol.

A note on his card made on the 28th September, 1912, says, "much improved —granular degeneration of bacilli." He went on improving, and on the 20th August, with Dr. Dickson, we made a complete examination (bacteriological), and found no *bacilli lepræ* from smears taken from the nose.

The patient was clean, strong, and with a complete absence of any signs of leprosy.

2. *A. Serrette:*—Aged 65, M., Ward No. VIII., admitted on 18th November, 1909, a case of tubercular leprosy, who, on admission, suffered from "tubercles of the face, cheeks, and forehead—both hands affected—fingers thickened, and glossy-penetrating ulcer of left foot."

Dr. Read began injections of nastin on November 27th, 1910, and from that date to the date of his discharge he received 110 injections.

During his stay at the asylum he took large quantities of chaulmoogra and antileprol, and gradually improved under that treatment.

When seen by Dr. Dickson and myself on the 29th August, 1913, we took smears from the nose and from fingers, and found no *bacilli lepræ*.

In fact, nothing of his former symptoms remained, and to all appearances he was a healthy man.

3. *A. Morin or Mohun:*—Aged 45. Admitted 29th January, 1913, Ward No. XII. This man had been an inmate of the asylum some years back. I am informed that his case was that of a mild anæsthetic type. On admission I found his case a very doubtful one; but on referring to his previous medical history I find that his case was noted when admitted about ten years previously as anæsthetic leprosy. From the records I am unable to find out whether he followed any special treatment—(10 years ago). Both Dr. Dickson and myself came to the conclusion that he showed no signs of leprosy.

4. *J. Edwards:*—This man was admitted on 19th September, 1912, aged 53, M. I had always doubted whether he was a leper or not, and Dr. Dickson and myself recommended him to be transferred to the House of Refuge as he was not a leper.

5. *Salamat:*—Admitted 9th August, 1910. Aged 13, Ward XII. On admission he had tubercules of "both ears, and tubercules on the face, and a large one on the chin." During his stay at the asylum he developed yaws, and was injected with "606" with beneficial results. Nastin treatment was begun on 31st May, 1911, and continued for some time—some 30 injections. During that time he also took chaulmoogra and cacodylate of sodium. When seen on the 29th August by Dr. Dickson and myself he was completely free from the disease, and was in a strong and healthy condition.

6. *C. Smith.*—Admitted 23rd November, 1910, aged 13. Ward No. II. A case of anæsthetic leprosy. On admission she suffered from two perforating ulcers of foot (ulcers most difficult to cure as a rule), and several leprotic spots on face and upper extremities. She received 67 injections of nastin, at the end of which time most of the leprotic spots had disappeared, and sensibility had returned on the fore-arm muscles. She also took cacodylate of sodium. I do not consider this case to be cured, although there was an absence of *bacilli lepræ*, when they were numerous on admission, but there has been an arrest in the disease with a fair prospect of complete cure. In her present condition she is non-contagious.

7. *I. Reid:*—Admitted 12th July, 1911, Ward No. II. Tubercules on ears and on face, hands swollen and glossy. Received 38 injections of nastin and took tincture of mangrove bark for some time (6 months). On the 20th August Dr. Dickson found an absence of *bacilli lepræ*, and no further marks of leprosy. Whilst not considering this case as cured, there is certainly a favourable arrest in the disease.

Remarks.

I beg to draw your attention to Cases 1, 2, and 5. You will note that on admission they all suffered from tubercular leprosy, and were treated with nastin and chaulmoogra and antileprol. In cases where there is no ulceration nastin is a valuable drug, especially in combination with antileprol. The treatment, however, to be successful must be undertaken for two or more years. This is why so

many patients give up the treatment after a few months' trial. These cases have to report themselves every quarter, and I shall closely watch the result.

Even supposing that the cure is only apparent, I consider that cases of this sort should not be kept further in the asylum for fear of re-infection.

I have, &c.,
F. A. de Verteuil,
Medical Superintendent, Leper Asylum.

The Honourable the
Acting Surgeon-General.

No. 16.

WINDWARD ISLANDS (St. Lucia).

EXTRACT FROM THE ANNUAL REPORTS ON THE HOSPITALS AND DISPENSARIES, 1912-13.

(Received 30 September, 1913.)

* * * * * * *

Yaws Hospital.

"Salvarsan."

245 cases of yaws were treated with this drug for the year, of which 229 were discharged cured. When one looks back and compares this number with the number of discharges under the old method of treatment, it will readily be admitted, I think, that the results are uniformly good and very gratifying.

Quantity and Method.

The full dose of ·6 gm. is administered to all patients over 14, and sometimes under this age, when the general appearance and weight permit. In children the dosage is regulated, among other factors, by the age and general condition.

The intramuscular method was the only one practised during the year. I do not think the time is yet ripe for the introduction of the intravenous method, which, though more rapidly beneficial and costing less, still has its disadvantages; among other things, there is a certain amount of risk attached to treatment by this method, and with the class of patients one meets at this institution, one untoward result would throw us right back, with the result that patients would then have to be hunted out as formerly, instead of coming forward voluntarily as at present obtains.

After-Treatment.

Rest in bed for about forty-eight hours, and then regular sea-bathing. I, at first, used to put the patients on mercury in the form of the ordinary *Lq. Hyd. Percl.* of the Pharmacopœia, but I have for some time discontinued this, and now administer Donovan's solution, starting with m x̄ doses and increasing this fairly rapidly till fairly large doses are being taken. In my hands, this drug gives far better results than the ordinary solution of mercury.

Effects.

In the great majority of cases, signs of healing are evident two to three days after injection, and the cases are fit for discharge in a fortnight or three weeks. A certain percentage of cases did not show any reaction after the one injection, which had to be repeated two or even three times. This was especially noticeable in a variety of the disease in which the skin lesions are quite dry, and do not contain the typical cheesy secretion. This variety of yaws attacks chiefly the exposed surfaces, such as the face, hands and feet. In some of the cases a brawny painless induration developed at the seat of puncture. This disappears with time and shows no signs of pus formation. In two or three cases necrosis resulted.

Appendix VI.

REPORTS ON WORK DONE IN COLONIAL LABORATORIES.

Recurrences.

At the time of writing ten recurrences of cases treated with this drug have been re-admitted into the institution. I have also seen two other cases which I have not yet been able to send to the hospital as the supply of the drug has run out, and these people will be disappointed in being kept at the hospital and not treated soon after admission.

Practically all the cases in my district have been inspected at regular periods after discharge, and I have been informed by District Medical Officers that any recurrences met with are sent to the institution.

Some difficulty is met with in getting the discharged patients to report to the District Medical Officers at regular intervals, and I fear they cannot be compelled to do so so long as they are free from yaws.

So far, therefore, of 245 cases, 12, or 5 per cent., have recurred. Even leaving a margin of 10 per cent. for recurrences, 90 per cent. of cures is exceptionally good, and I submit justifies the continued use of the drug.

Nearly all the cases which recurred did so within three months after discharge from the hospital, and I am inclined to the opinion that these cases did not receive a sufficient dose.

It must be borne in mind that some of the cases which are regarded as recurrences may in reality be cases of re-infection, as one attack of yaws by no means confers permanent immunity.

General.

As will be seen from the returns for the dispensaries in my district there has been an unprecedented number of cases of yaws presenting themselves for admission to the Yaws Hospital for treatment with the drug. In every instance this request was quite voluntary. If the supply of the drug had been regular and sufficient the number of admissions would have been far in excess of what it was, as I was reluctantly compelled to put off several requests for admission till a further supply comes to hand, as they would have been disappointed in not being treated soon after admission. I have seen several cases treated months ago who are now most cheerful, able-bodied workmen. In conclusion, I am of the opinion that, so far, the uniformly successful results of treatment with this drug justifies its continued use.

*   *   *   *   *   *   *

TROPICAL DISEASES RESEARCH FUND.

REPORT

OF THE

ADVISORY COMMITTEE FOR THE TROPICAL DISEASES RESEARCH FUND

For the Year 1914.

(*For Report for* 1913 *see* [*Cd.* 7261] *March*, 1914.)

Presented to both Houses of Parliament by Command of His Majesty.
April, 1915.

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APPENDIX I.

Circular Despatch from the Secretary of State, 20th December, 1910 4

Reports on Anti-Malarial Measures in the Crown Colonies and Protectorates, &c.

Serial No.	From or to whom.	Colony, &c.	Date.	Subject.	Page.
			1914		
1	—	Windward Islands, St. Vincent	(Rec. Jan. 21, 1914.)	Returns of mosquito-borne diseases for 1911-12 and 1912-13.	8
2	The Medical Officer of Health	Hong Kong	February 24 (Rec. March 26.)	Report for 1913 on the prevention of mosquito-borne diseases in Hong Kong.	19
3	The Government Medical Officer	British Solomon Islands Protectorate	December 1, 1913. (Rec. May 4, 1914.)	Report for 1912 on the prevention of mosquito-borne diseases.	23
4	Ditto	British Solomon Islands Protectorate	January 5 (Rec. May 4.)	Report for 1913 on the prevention of mosquito-borne diseases.	25
5	The Principal Medical Officer	Uganda	April 23 (Rec. May 23.)	Statistics of mosquito-borne diseases for the year ending 31st December, 1913.	26
6	The High Commissioner	South Africa	May 9 (Rec. May 26.)	Forwards despatches from the Resident Commissioner, Swaziland, and the Administrator, Southern Rhodesia, reporting on mosquito-borne diseases in those territories for 1913.	34
7	Ditto	South Africa	November 25 (Rec. Dec. 18.)	Transmits copy of a despatch from the Administrator, Northern Rhodesia, enclosing a report on mosquito-borne diseases for the year ending 31st March, 1914.	37
8	The Senior Medical Officer	Leeward Islands	March 31 (Rec. May 26.)	Return of mosquito-borne diseases for 1913.	39
9	The Principal Medical Officer	Nyasaland	(Rec. July 7.)	Return of mosquito-borne diseases for 1913.	50
10	Dr. R. Laurie ...	Southern Nigeria	April 26 (Rec. Aug. 10.)	Return of mosquito-borne diseases for 1913.	52

Serial No.	From or to whom.	Colony, &c.	Date.	Subject.	Page.
			1914		
11	Principal Civil Medical Officer	Straits Settlements	June 25 (Rec. Aug. 14.)	Return of mosquito-borne diseases for 1913.	55
12	The Chief Secretary	Zanzibar	July 10 (Rec. July 20.)	Transmits a report by Major Skelton, R.A.M.C., on the prevention of mosquito-borne diseases during 1913.	61
13	The Acting Governor	Mauritius	July 27 (Rec. Sept. 16.)	Forwards return of malarial fever and tropical diseases for 1913.	66
14	—	Australia (Northern Territories)	(Rec. Oct. 2.)	Returns relating to mosquito-borne diseases for 1912 and 1913.	69
15	—	Trinidad	(Rec. Oct. 29.)	Return of mosquito-borne diseases during the year 1913.	72

APPENDIX II.

Reports of the Professor of Protozoology at the University of London and his Assistant, for the Year ended 30th June, 1914.

			1914		
1	University of London	—	(Rec. Nov. 3.)	Report of the Professor of Protozoology for the year ended 30th June, 1914.	76
2	Ditto	—	August 10	Report by Dr. Woodcock, Assistant to the Professor of Protozoology, on work done by him during the year ended 30th June, 1914.	81

APPENDIX III.

Report for 1914 on the Work of the Quick Laboratory at Cambridge, 12th November, 1914 87

APPENDIX IV.

Reports from the London School of Tropical Medicine for the Year ended 31st October, 1914, including a Report by Dr. R. T. Leiper on Schistosomiasis.

			1914		
1	London School of Tropical Medicine	—	May 13	Forwards reports of the Departments of Entomology, Helminthology, and Protozoology for the half-year ended 30th April, 1914.	89
2	Ditto	—	October 30	Forwards the report of the entomologist for the six months, and that of the protozoologist for the three months, ended 31st July.	94
			1915		
3	Dr. R. T. Leiper (London School of Tropical Medicine)	—	January 1	Furnishes a report of his visit to Shanghai to carry out investigations upon trematode infections of man.	96

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APPENDIX V.

Reports from the Liverpool School of Tropical Medicine for the Year ended 31st October, 1914.

Serial No.	From or to whom.	Colony, &c.	Date.	Subject.	Page.
			1914		
1	Liverpool School of Tropical Medicine	—	April 30	Forwards reports of the School for the six months ending 30th April on the work done in connexion with the Government grant, together with a statement of expenditure of the grant for the year ended 31st December, 1913.	101
2	Ditto	—	October 31	Forwards reports on the work of the School for the six months ended 31st October.	107

APPENDIX VI.

Report from the Wellcome Research Laboratories at Khartoum; 2nd December, 1914 113

APPENDIX VII.

Observations on the Life History of Dermatobia hominis, by Dr. Louis W. Sambon; February, 1915 119

APPENDIX VIII.

Reports on Work carried out in Colonial Laboratories.

			1914		
1	The High Commissioner	Malay States	Dec. 31, 1913 (Rec. Jan. 24, 1914.)	Transmits a report on the work done at the Institute for Medical Research, Kuala Lumpur, for the period 1st April to 30th September, 1913.	151
2	Government Bacteriologist	Hong Kong	January 28 (Rec. March 6.)	Report on work (other than routine work) done in the Bacteriological Institute during the six months, 1st July to 31st December, 1913.	187
3	The Governor ...	Hong Kong	September 7 (Rec. Oct. 26.)	Transmits a copy of a report on the work, other than that of a routine nature, done in the Bacteriological Institute during the first half of 1914.	187
4	Ditto	Ceylon	February 21 (Rec. March 14.)	Transmits a report by Dr. Aldo Castellani on research work carried out at the Clinic for Tropical Diseases and Bacteriological Institute during the period 1st July, 1913, to 31st January, 1914.	189
5	Ditto	Ceylon	August 3 (Rec. Aug. 25.)	Forwards a report by Dr. Aldo Castellani on research work carried out at the Clinic for Tropical Diseases and Bacteriological Institute during the period 1st January—30th June, 1914.	197
6	Ditto	Jamaica	April 20 (Rec. May 9.)	Forwards report of the Government Bacteriologist on work carried out during the half year, 1st October, 1913, to 31st March, 1914.	215
7	Ditto	Jamaica	October 16 (Rec. Nov. 3.)	Transmits report of the Government Bacteriologist on the work done at the Pathological Laboratory during the period 1st April to 30th September, 1914.	232

REPORT

OF THE

ADVISORY COMMITTEE

FOR THE

TROPICAL DISEASES RESEARCH FUND

For the Year 1914.

Report.

The Advisory Committee for the Tropical Diseases Research Fund was constituted by the Secretary of State for the Colonies in July, 1904. It is now composed as follows:—

The Right Honourable Sir J. West Ridgeway, G.C.B., G.C.M.G., K.C.S.I., P.C., LL.D. (Chairman).
Sir Thomas Barlow, Bart., K.C.V.O., M.D., F.R.S.
Sir John Rose Bradford, K.C.M.G., M.D., F.R.S.
Surgeon-General Sir David Bruce, C.B., F.R.S., A.M.S.
Surgeon-General Sir R. Havelock Charles, G.C.V.O., M.D., I.M.S. (retd.)
Mr. F. C. Drake.
Sir Patrick Manson, G.C.M.G., M.D., F.R.S.
Mr. H. J. Read, C.B., C.M.G.
Lieutenant-Colonel Sir Ronald Ross, K.C.B., F.R.S.
Mr. J. A. C. Tilley.
Mr. A. C. C. Parkinson (Secretary).

The revenue of the Tropical Diseases Research Fund for the year 1914 was made up as follows:—

Contribution from the Imperial Government	£1,000
Contribution from the Government of India	500
Making a total of	£1,500

Contributions from the Dominion and Colonial Governments:—

Commonwealth of Australia	£200	
Nigeria	400	
Gold Coast	200	
East Africa Protectorate	200	
Ceylon	100	
Hong Kong	100	
Malay States	100	
Straits Settlements	100	
British Guiana	100	
Jamaica	100	
Trinidad	100	
Gambia	100	
Sierra Leone	100	
Fiji	100	
Zanzibar	100	
British Honduras	50	
Grenada	50	
Leeward Islands	25	
St. Vincent	20	
Making a total of		£2,245
In all a total of		£3,745

The expenditure of the year was made up as follows:—

To the London School of Tropical Medicine	£1,450
To the Liverpool School of Tropical Medicine	1,200
To the University of London	850
To the University of Cambridge	750
Making a total of ...	£4,250

The excess of expenditure over income was met, as in the previous year, by drawing on the accumulated balance of the Fund, which was thus reduced to about £750.

After consulting the Advisory Committee the Secretary of State addressed a circular despatch early in the year to the Governments which contribute to the Fund. In this despatch Mr. Harcourt pointed out that the period of five years for which grants had been promised by those Governments in 1909, at the instance of his predecessor, had now expired. Since 1909, as shown by the Annual Reports issued by the Advisory Committee, the work carried on with the assistance of grants made from the Fund had steadily increased, and there could be no doubt of the great importance and value of the investigations which were rendered possible by the existence of the Fund. He accordingly asked that the contributions might be continued for the further period of five years. The proposal was accepted by the Governments concerned, thus ensuring the continuance of the work for a further period of five years. The Committee have learnt with particular satisfaction that the Government of the Commonwealth of Australia have decided to invite the Commonwealth Parliament to continue the grant of £200 made on behalf of the Northern Territory of Australia.

Of the grant (£1,450) to the London School of Tropical Medicine, £1,200 was expended in respect of the salaries, and the maintenance of the laboratories, of the teachers and investigators of helminthology, protozoology, and entomology; and £250 was given as a contribution towards the investigation of schistosomiasis carried out by Dr. R. T. Leiper in the Far East. A preliminary report by Dr. Leiper is printed in Appendix IV.; from this it appears that he has obtained important results, bearing not only on the disease which he was studying in China and Japan, but also, indirectly, on bilharzia disease—a disease which is prevalent in Africa and tropical America, and which has been reported from Australia, Cyprus, and India.

Of the grant (£1,200) to the Liverpool School of Tropical Medicine, £500 was spent on the research work on trypanosomiasis at the research laboratories of the School, £250 on research work on parasitology and helminthology, £250 on research work on entomology, and £200 on research work on malaria.

Of the grant to the University of London (£850) £750 was expended in paying the salary of the Professor of Protozoology, whose post was established in the year 1906 by means of a grant from the Fund and whose tenure of office was extended for another period of five years in 1911. On the application of the University a further sum of £100 was granted as a contribution towards the salary of the Scientific Assistant to the Professor, Dr. H. M. Woodcock.

Of the grant to the University of Cambridge (£750) £100 was paid in respect of the Research Studentship in Medical Entomology established in 1907 by means of a grant from the Fund, £100 was paid towards the salary of an Assistant to the Quick Professor, £100 towards the payment of an helminthologist to work in the Quick Laboratory, £50 towards the salary of a demonstrator in medical entomology, and £100 for the general purposes of the Quick Laboratory. A special grant of £300 was made towards the expenses of sending the Assistant to the Professor, Dr. E. Hindle, to Uganda and Nyasaland for the purpose of carrying out research work there. Owing to the outbreak of war the expedition has been postponed, but the sum of £300 will remain earmarked for this work.

The Committee were consulted on various matters during the year by the Secretary of State, including the question of the terms of the Lepers Ordinance of Trinidad and the Jamaica Law, No. 19 of 1914, relating to yaws.

The Committee append to the report the statistics received from certain Colonies and Protectorates with regard to mosquito-borne diseases, which are supplied in accordance with the request contained in the Secretary of State's circular despatch of the 20th of December, 1910, which is reprinted for convenience of reference. The Committee have observed with satisfaction that the reports have, on the

whole, been prepared with much care, and they desire to call special attention to the valuable reports supplied by Hong Kong, Zanzibar, and the Straits Settlements.

The Committee also append reports of the work done at the London and Liverpool Schools of Tropical Medicine for the year November, 1913, to October, 1914; the reports of the Professor of Protozoology in the University of London and of his Assistant for the year ended June, 1914; reports on work done at various Colonial Laboratories which have been sent in accordance with the request made by the Secretary of State for the Colonies in December, 1906; and a report by Professor Nuttall on the work done in the Quick Laboratories. The Committee desire again to record their sense of the importance of the work in which the Colonial Laboratories are now engaged.

In the Appendix will also be found an interesting and valuable report by Dr. Louis W. Sambon on *Dermatobia hominis* in the West Indies, where he has recently been conducting inquiries.

It was arranged early in the year that a resumé of the Annual Report of the Gordon College Research Laboratories at Khartoum should be included in future in this report, and the Committee have accordingly appended a resumé for which they are indebted to the Director of the Wellcome Tropical Research Laboratories.

The reports from the Laboratory maintained by the Governments of the West African Dependencies at Yaba and from the Laboratory maintained by the Government of the East Africa Protectorate at Nairobi are not reprinted, as they are published separately by these Governments.

The Committee would not wish me to conclude this report without an expression of their regret at the loss of the services of Dr. A. Berriedale Keith, who has acted as Secretary since the Committee was appointed, and of their appreciation of the efficiency and zeal with which he invariably discharged his duties.

WEST RIDGEWAY.

A. C. C. Parkinson,
Secretary.
30th March, 1915.

APPENDIX I.

Reports on Anti-Malarial Measures in the Crown Colonies and Protectorates, &c.

CIRCULAR DESPATCH FROM THE SECRETARY OF STATE FOR THE COLONIES.

SIR, Downing Street, 20th December, 1910.

I HAVE the honour to enclose the accompanying copy of a note which has been prepared by Professor Ronald Ross on the subject of the prevention of mosquito-borne diseases in the tropical Colonies and Protectorates.

2. This note has been prepared by Professor Ross at my request, on the recommendation of the Advisory Committee of the Tropical Diseases Research Fund, and the Committee concur in the views expressed in it.

3. I shall be glad, therefore, if, as far as may be found possible and as far as the exigencies of professional duties allow, the statistics suggested in the draft return accompanying the note can be supplied annually by your Government; but if it is found in any case impossible without undue labour to supply the information required, that fact should simply be stated, as it is not my desire to overload the medical or other officers in the territory under your Government with the collection of elaborate statistics. I understand, however, that much of the information should already be available, and that the additional information required, if it can be supplied, will be of great value, both as a record of the state of health in the Colony and as affording a basis for further scientific research.

I have, &c.,
L. HARCOURT.

NOTE BY PROFESSOR RONALD ROSS ON THE PREVENTION OF MOSQUITO-BORNE DISEASES IN THE COLONIES: SUGGESTED RETURN.

1. Towards the end of last year the Advisory Committee invited me to furnish them with my remarks on the various reports which have been sent in by the Colonies for some years past on the subject of mosquito-borne diseases, especially malaria. At that time I had just commenced the compilation of a book on the prevention of malaria in which I hoped to collect in one volume accounts of such work done in many parts of the world; and I therefore asked to be allowed to postpone my remarks on local malaria until this was finished and also until I should have time to complete not a few brief notes, but a detailed exposition on the subject in connexion with each individual malarious British possession.

Unfortunately, my book was not finished until near the end of July, and though I have commenced the compilation of the detailed reports referred to, I have not yet had time, in the midst of much other work, to do more than commence them; but I should like to furnish for the next meeting of the Committee a brief note on the subject, especially regarding a draft return which I should like to submit for their consideration.

2. As shown in the report of the Advisory Committee for 1907,* Lord Elgin asked the Colonies for reports on the prevention of mosquito-borne diseases, and many such reports have been submitted since then. I have, of course, studied them all with care, and my general conclusion regarding them is that the details of the information required have not always been understood—a thing which is scarcely to be wondered at in connexion with such a new subject. It may, therefore, be suggested that a special form, containing headings for all such details, may be sent to each Colony to be filled in every year. The draft which I enclose is meant merely for consideration, and may require alterations. I will now explain why the various headings are inserted.

3. It seems to me best to approach the prevention of disease not so much from its humanitarian as from the economical point of view. Disease always causes a large expenditure of money, both to the people of a Colony and directly to the Government, and mosquito-borne disease is especially a source of such

* [Cd. 3992] March, 1908.

expense, owing to its wide and permanent endemicity, both among the populace and among Government servants. In fact, the prevention of disease should be looked upon economically as being a kind of insurance against the useless expenditure caused by such maladies; and a return of the kind proposed should aim at giving figures which will enable us to estimate both the cost of the disease and the cost of the preventive measures. Such a return will, however, have the advantage not only of being a permanent record on such points, but of indicating many of the steps which may be taken in the line of scientific and methodical prevention.

4. I have therefore endeavoured to include in my proposed draft headings which will deal with all the more important items. Headings 2, 3, 4, and 5 explain themselves. Headings 6 and 7 will enable us to compute the amount of sickness due to the mosquito-borne diseases compared with the total amount of sickness and death. Heading 8 will give information regarding the medical and sanitary staff of the Colony. Heading 9 (schools) will furnish very useful information regarding the sickness amongst children and also regarding the possibility of utilizing schools for prophylaxis amongst the scholars. Similar information will be given by heading 10 in connexion with estates employing indentured labour. Headings 11 and 12 will supply necessary facts regarding revenue and expenditure of the Colony. Heading 13 will distinguish details regarding the urban population. Headings 14 and 15 are arranged in order to give information regarding the malaria mortality by means of Meldrum's law, according to which the excess of the mortality during the malaria months over the mortality during the healthiest month may be roughly ascribed to this disease. Heading 16 gives the rainfall for the purpose of scrutinizing the monthly mortality returns; and heading 17 will furnish detailed information upon the steps which have been taken for prevention.

5. Though I am not yet ready to examine the reports for each malarious Colony, I should like to add one or two notes regarding some of them.

We are much obliged to Sir Allan Perry for his excellent reports for Ceylon during 1907, 1908, and 1909—reports which give a clear picture of the energetic measures being taken there. I note especially the very large estimations of spleen rates. Thus, during 1909 no less than 317,694 children were examined, of which 66,141 were found to be suffering from enlargement of the spleen, showing the immense prevalence of the disease and the cost which it must inflict upon the public at large. I note also the fact that quinine is distributed in the schools, that sanitary instruction is given to school teachers, that pamphlets in the vernacular languages are distributed, that mosquito reduction in small towns is being undertaken, but that mosquito brigades have not yet been established in all of them as suggested by Sir Allan Perry (Advisory Committee's Report for 1909,* page 10). I think, however, that this will only be a question of time, especially as we cannot help observing the interest taken in the matter in Ceylon and also the great expenditure which the disease must entail there.

The report for Mauritius (*ibid* page 12) is not less interesting. Pending the submission of the report of the Royal Commission (1909) the Colony has been able to spend only the small sum of Rs. 6,000 per annum on the preventive measures recommended by me, but it has done so very wisely and with results which appear already to be excellent. The measures have included examination of school children and free grant of quinine to them, similar measures on the estates, a house-to-house spleen census at Port Louis with distribution of quinine, minor mosquito-reduction works in many places, and even some major works. Dr. Bolton, the Medical Officer of the Immigration Department, is now in England, and I have asked him to inform me by letter exactly what has been done—a subject of which he is thoroughly cognizant. I enclose his communication,† which I think may be of interest to the Committee. The eradication of malaria at Phoenix is a noteworthy example of what may be done. When I was there in 1907 a severe epidemic of malaria was raging in the neighbourhood and amongst British troops stationed there. Within one month no less than 71 soldiers were attacked. There were five deaths and, so far as I can remember, some 30 soldiers had to be invalided to England at a cost of over £50 each (I believe). The War Office granted £1,000 for the drainage

* [Cd. 4999], February, 1910. † Not printed.

of the marsh at Phoenix; but it will be observed that the invaliding of the soldiers during one month cost them more than the money which they allotted for assisting the local Government as regards prevention. Since then the drainage of the marsh has been followed by practical obliteration of the disease on the spot—though, of course, soldiers occasionally become affected elsewhere. I am glad to see that the Royal Commission recommend that the system indicated in my report, viz., regular doses of quinine, the use of mosquito-nets, the canalization of streams, and the drainage of swamps, should be carried out as far as the resources of the Colony will permit.

I will reserve remarks upon the reports from the other Colonies until I have had time to study their statistics in full.

Ronald Ross,
Professor of Tropical Medicine,
University of Liverpool.

8th November, 1910.

Annexure.

(Draft) Return of Malarial Fever, Blackwater Fever, Yellow Fever, Filariasis, and Dengue during the year from the 1st January to the 31st December (1910).

1. Name of Colony.
2. Total area.
3. Estimated population :—
   (*a*) Total.
   (*b*) Europeans.
   (*c*)
   (*d*) Other races.
   (*e*)
4. Births during the year :—
   Total births.
5. Deaths during the year :—
   (*a*) Total deaths.
   (*b*) Deaths ascribed to fever.
   (*c*) Deaths ascribed to blackwater fever.
   (*d*) Deaths ascribed to yellow fever.
6. Government hospitals :—
   (*a*) Number of such hospitals.
   (*b*) Totals, during year { admissions. deaths.
   (*c*) Malarial fever { admissions. deaths.
   (*d*) Blackwater fever { admissions. deaths.
   (*e*) Yellow fever { admissions. deaths.
   (*f*) Filarial diseases { admissions. deaths.
   (*g*) Dengue { admissions. deaths.
7. Government dispensaries :—
   (*a*) Number of such dispensaries.
   (*b*) Total attendances during year.
   (*c*) Attendances for malaria.
   (*d*) Attendances for filarial diseases.
   (*e*) Attendances for dengue.
8. Medical Service :—
   (*a*) Number of Government Medical Officers.
   (*b*) Number of special Health Officers.
   (*c*) Number of other registered practitioners.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

9. Schools :—
   (*a*) Number of Government and State-Aided Schools.
   (*b*) Number of scholars registered in these schools.
   (*c*) Percentage of daily attendances.
10. Estates employing indentured labour :—
   (*a*) Number of such.
   (*b*) Number of indentured labourers employed.
   (*c*) Number of hospitals and dispensaries on such estates.
   (*d*) Total deaths among such labourers.
   (*e*) Deaths ascribed to malaria.
   (*f*) Total admissions and attendances at hospitals and dispensaries.
11. Estimated revenue of Colony :—
   Total during year.
12. Estimated expenditure of Colony :—
   (*a*) Total during year.
   (*b*) Annual medical and sanitary expenditure.
   (*c*) Upkeep of Government hospitals and dispensaries.
   (*d*) Total salaries and allowances of medical officers.
   (*e*) Total annual sanitary expenditure.
13. Towns under Municipalities or Town Councils :—
   (*a*) Number of such.
   (*b*) Total population.
   (*c*) Total revenues.
   (*d*) Total medical and sanitary expenditure.
14. Table of deaths by districts :—

District	Area.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total															

15. Table of deaths in the principal towns :—

Town	District where situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total															

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

16. Rainfall during the year :—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total														

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Numbers of notices, convictions, and warnings during the year.

(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does kala-azar exist?

(*c*) Number of persons examined for filarial diseases. Where was this done? Percentage affected.

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.

(*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed.

(*g*) Is quinine distributed regularly in the schools?

(*h*) Measures taken against these diseases on estates employing indentured labour.

(*i*) Any steps taken regarding the housing of the poor.

(*j*) Any exceptional increase or decrease of these diseases recently noticed.

(*k*) Any other remarks on the subject.

No. 1.

WINDWARD ISLANDS: St. Vincent.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM 1st APRIL, 1911, to 31st MARCH, 1912.

(Received 21st January, 1914.)

1. Name of Colony	St. Vincent.
2. Total area	150·3 square miles.
3. Estimated Population :—	
(a) Total	43,117 (at 31st March, 1912).
(b) Europeans ...	Information not available.
(c) Other races ..	
4. Births during the year :—	
Total births	1,790
5. Deaths during the year :—	
(a) Total deaths	914
(b) Deaths ascribed to fever...	7
(c) ,, ,, blackwater fever	Nil
(d) ,, ,, yellow fever	Nil

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

6. Government Hospitals :—	
(a) Number of such hospitals	2 (Colonial Hospital, Kingstown, and Casualty Hospital, Georgetown).
(b) Totals during the year— admissions	1,023
deaths	56
(c) Malarial fever—admissions	34
deaths ...	4
(d) Blackwater fever— admissions ...	Nil
deaths ...	,,
(e) Yellow fever—admissions	Nil
deaths ...	,,
(f) Filarial diseases— admissions ...	17
deaths ...	1
(g) Dengue—admissions ...	Nil
deaths ...	,,
General.	
7. Government Dispensaries :—	
(a) Number of such dispensaries	5
(b) Total attendances during the year	17,346*
(c) Attendances for malaria	278
(d) Attendances for filarial diseases	83
(e) Attendances for dengue...	Nil
8. Medical Service :—	
(a) Number of Government Medical Officers ...	7
(b) Number of Special Health Officers	By law each Medical Officer is Health Officer in his district.
(c) Number of other registered practitioners ...	16, of whom only two reside in the Colony.
9. Schools :—	
(a) Number of Government and state-aided schools	26†
(b) Number of scholars registered in these schools	4,475 (at 31st March, 1912).
(c) Percentage of daily attendances	2,193 (*average* attendance).
10. Estates employing indentured labour	Nil
11. Estimated revenue of Colony:— Total during year	£31,076
12. Estimated expenditure of Colony :—	
(a) Total during year ...	£31,886
(b) Annual medical and sanitary expenditure ...	£5,015

* These figures represent the number of *cases*, each of which may have been *attended* two or three times. Attendances cannot be given.

† These are the elementary schools fully recognized. Besides a number of private schools, there are a few other "aided" elementary schools in regard to which no statistics are available. There are also two recognized secondary schools, in regard to which statistics cannot be given.

	(c) Upkeep of Government hospitals and dispensaries	£3,335
	(d) Total salaries and allowances of Medical Officers	£1,802
	(e) Total annual sanitary expenditure	£12
13.	Towns under Municipalities or Town Councils :—	
	(a) Number of such ...	6
	(b) Total population ...	7,682 (3,264 males and 4,415 females), according to census of 1911.
	(c) Total revenues (for *1911*)	£2,183 15 0
	(d) Total medical and sanitary expenditure (*1911*) ...	£264 5 0
14.	Table of deaths by Districts ...	See annexed Table.
15.	Table of deaths in the principal towns	"
16.	Rainfall during the year ...	"
17.	Additional information to be given, if possible, on the following points :—	
	(a) Is there any legislation in force against the breeding of mosquitoes in premises?	Yes, in the Public Health Ordinance, 1910, sections 9 and 19, sub-section (3).
	Number of notices, convictions and warnings during the year	Nil
	(b) Number of children examined for enlarged spleen. Where was this done? Percentage affected.	No systematic examination was carried out.
	Does Kala-azar exist? ...	One case diagnosed.
	(c) Number of persons examined for filarial diseases. Where was this done? Percentage affected.	No systematic examination was carried out.
	(d) Any large works for surface drainage of towns or reclamation of marshes.	No
	Approximate cost	Nil
	For Specific Purposes.	
	(e) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.	In Kingstown there is a Sanitary Inspector continuously employed at £36 per annum. When necessity exists therefor others are taken on temporarily. In addition the Government employs a man to inspect the environs of Kingstown for stagnant water, etc., regularly. Elsewhere in the Colony, such Inspectors are only employed when necessary.

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(f) Amount of Government quinine sold or distributed gratis during the year	About 4½ lbs.
Agencies employed ...	Hospitals and Dispensaries.
(g) Is quinine distributed regularly in the schools?	No. Unnecessary.
(h) Measures taken against these diseases on estates employing indentured labour ...	No indentured labour.
(i) Any steps taken regarding the housing of the poor	None.
(j) Any exceptional increase or decrease of these diseases recently noticed	No.
(k) Any other remarks on the subject?	No.

14. TABLE OF DEATHS BY DISTRICTS :—

District.	Area.	Population.	Total Deaths.												
			April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
First District	—	—	20	27	25	27	30	21	32	27	25	27	24	21	306
Second do.	—	—	37	49	56	52	49	53	43	42	44	49	48	39	561
Third do.	—	—	5	—	—	4	4	4	7	5	7	4	2	5	47
	Total		62	76	81	83	83	78	82	74	76	80	74	65	914

15. TABLE OF DEATHS IN THE PRINCIPAL TOWNS :—

Town.	District where Situated.	Population of Town.	Total Deaths.												
			April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Kingstown...	First	4,300	8	16	16	14	16	13	18	10	13	14	8	15	161
Calliaqua	Second... ...	551	1	2	1	1	1	1	1	1	1	1	—	1	12
Georgetown	do.	431	2	1	3	1	1	1	—	2	1	2	1	—	15
Layou	do.	441	1	2	3	2	1	1	—	—	1	2	—	—	13
Barrouallie	do.	1,240	3	—	2	1	—	1	—	—	—	2	—	1	10
Chateaubelair	do.	719	—	—	—	6	2	3	—	1	—	—	2	1	15
	Total		15	21	25	25	21	20	19	14	16	21	11	18	226

N.B.—The above population is according to Census of 1911.

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16. RAINFALL DURING THE YEAR 1911-12:—

Where observed.	District.	Rainfall.												
		April, 1911.	May.	June.	July.	August.	September.	October.	November.	December.	January, 1912	February.	March.	Total.
														Inches.
Botanic Station (200ft.) ...	Leeward (South) ...	5·27	11·04	14·96	11·52	14·04	21·81	9·32	10·03	6·45	6·61	3·93	4·09	119·07
Agricultural School ...	do. do. ...	3·98	8·78	13·10	12·81	11·87	19·28	9·24	9·06	4·82	7·17	2·17	3·95	106·23
Georgetown	Windward (North) ...	6·03	14·32	5·62	6·06	8·95	9·93	5·65	7·26	5·09	5·12	1·62	0·85	76·50
Ratho Mill	do. (South) ...	2·90	9·13	8·70	8·72	8·85	12·94	6·08	6·61	3·04	3·02	0·57	1·13	71·69
Bequia	Grenadines (North) ...	1·77	5·51	6·19	7·17	8·63	9·15	5·06	9·34	2·59	3·34	1·76	1·22	61·73
Peter's Hope	Leeward (Middle) ...	2·11	8·02	14·15	12·64	14·20	13·22	5·67	7·64	3·64	6·07	1·52	3·28	92·16
Villa Point	Windward (South) ...	1·63	7·60	10·67	8·63	6·79	13·61	8·55	8·55	2·21	2·88	1·39	2·22	74·73
	Total ...	23·69	64·40	73·39	67·55	73·33	99·94	49·57	58·49	27·84	34·21	12·96	16·74	602·11

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

WINDWARD ISLANDS: St. Vincent.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM 1st APRIL, 1912, to 31st MARCH, 1913.

(Received 21st January, 1914.)

1. Name of Colony	St. Vincent.
2. Total area	150·3 square miles
3. Estimated Population:—	
(a) Total	44,434 (at 31st March, 1913).
(b) Europeans	Information not available.
(c) Other races	
4. Births during the year:—	
Total births	1,678
5. Deaths during the year:—	
(a) Total deaths	878
(b) Deaths ascribed to fever ...	11
(c) ,, ,, blackwater fever	Nil
(d) ,, ,, yellow fever	Nil
6. Government Hospitals:—	
(a) Number of such hospitals...	2 (Colonial Hospital, Kingstown, and Casualty Hospital, Georgetown).
(b) Totals during the year—	
admissions	816
deaths	46
(c) Malarial fever—admissions	30
deaths ...	1
(d) Blackwater fever—	
admissions	Nil
deaths ...	,,
(e) Yellow fever—admissions	Nil
deaths ...	,,
(f) Filarial diseases—	
admissions	24
deaths ...	1
(g) Dengue—admissions ...	Nil
deaths	,,
General.	
7. Government Dispensaries:—	
(a) Number of such dispensaries	5
(b) Total attendances during the year	18,079*
(c) Attendances for malaria ...	339
(d) Attendances for filarial diseases	78
(e) Attendances for dengue ...	Nil
8. Medical Service:—	
(a) Number of Government Medical Officers ...	7
(b) Number of Special Health Officers.	By law each Medical Officer is Health Officer in his district.
(c) Number of other registered practitioners.	19, of whom only two reside in the Colony.

* These figures rpresent the numbers of *cases*, each of which may have been *attended* two or three times. Attendances cannot be given.

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9. Schools :—	
(a) Number of Government and state-aided schools ...	26*
(b) Number of scholars registered in these schools ...	4,458
(c) Percentage of daily attendances	2,186
10. Estates employing indentured labour	Nil
11. Estimated revenue of Colony :— Total during year	£34,393
12. Estimated expenditure of Colony :—	
(a) Total during year	£33,772
(b) Annual medical and sanitary expenditure ...	£5,257
(c) Upkeep of Government hospitals and dispensaries	£3,383
(d) Total salaries and allowances of Medical Officers	£1,904
(e) Total annual sanitary expenditure	£64
13. Towns under Municipalities or Town Councils :—	
(a) Number of such	6
(b) Total population ...	7,682 (3,264 males and 4,415 females), according to census of 1911.
(c) Total revenues (for *1912*) ...	£2,019 3 0
(d) Total medical and sanitary expenditure (*1912*) ...	£316 5 0
14. Table of deaths by Districts ...	See annexed Table.
15. Table of deaths in the principal towns	,,
16. Rainfall during the year ...	,,
17 Additional information to be given, if possible, on the following points :—	
(a) Is there any legislation in force against the breeding of mosquitoes in premises?	Yes, in the Public Health Ordinance, 1910, sections 9 and 19, sub-section (3).
Number of notices, convictions and warnings during the year.	17 (12 convictions, 3 dismissals, 1 withdrawn, 1 warned).
(b) Number of children examined for enlarged spleen. Where was this done? Percentage affected.	No systematic examination was carried out.
Does Kala-azar exist? ...	No cases diagnosed.
(c) Number of persons examined for filarial diseases. Where was this done? Percentage affected?	No systematic examination was carried out.

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* These are the elementary schools fully recognized. Besides a number of private schools, there are a few other "aided" elementary schools in regard to which no statistics are available. There are also two recognized secondary schools, in regard to which statistics cannot be given.

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(d) Any large works for surface drainage of towns or reclamation of marshes	No.
Approximate cost	Nil.
For Specific Purposes.	
(e) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.	In Kingstown there is a Sanitary Inspector continuously employed at £36 per annum. When necessity exists therefor others are taken on temporarily. In addition the Government employs a man to inspect the environs of Kingstown for stagnant water, etc., regularly. Elsewhere in the Colony such Inspectors are only employed when necessary.
(f) Amount of Government quinine sold or distributed gratis during the year	4 lbs. $3\frac{1}{2}$ oz.
Agencies employed	Hospitals and Dispensaries.
(g) Is quinine distributed regularly in the schools? ...	No. Unnecessary.
(h) Measures taken against these diseases on estates employing indentured labour	No indentured labour.
(i) Any steps taken regarding the housing of the poor	None.
(j) Any exceptional increase or decrease of these diseases recently noticed	No.
(k) Any other remarks on the subject?	No.

14. Table of Deaths by Districts :—

District.	Area.	Population.	Total Deaths.												
			April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
First District	—	—	31	26	15	25	26	17	20	25	22	26	16	21	270
Second do.	—	—	50	63	57	52	49	38	37	50	51	53	32	41	573
Third do.	—	—	2	4	3	4	7	—	1	4	4	3	2	1	35
Total			83	93	75	81	82	55	58	79	77	82	50	63	878

15. Table of Deaths in the Principal Towns :—

Town.	District where Situated.	Population of Town.	Total Deaths.												
			April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Kingstown...	First	4,300	22	11	9	17	18	10	9	11	15	15	10	13	160
Calliaqua	Second... ...	551	1	3	1	1	—	1	4	4	1	1	—	—	17
Georgetown	do.	431	1	3	—	3	—	2	2	3	1	2	1	1	19
Layou	do.	441	—	—	2	—	1	—	1	1	2	2	1	—	10
Barrouallie	do.	1,240	1	2	1	4	2	2	1	—	2	3	—	—	18
Chateaubelair	do.	719	3	3	—	—	4	—	3	1	1	1	1	2	19
Total			28	22	13	25	25	15	20	20	22	24	13	16	243

N.B.—The above population is according to Census of 1911.

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16. Rainfall during the Year 1912-13 :—

Where observed.	District.	Rainfall. April, 1912.	May.	June.	July.	August.	September.	October.	November.	December.	January, 1913.	February.	March.	Total.
														Inches.
Botanic Station (200ft.) ...	Leeward (South) ...	4·45	2·72	6·23	8·79	9·59	6·35	11·51	10·91	11·93	11·05	4·29	7·08	94·90
Agricultural School ...	do. do. ...	3·43	1·85	5·80	7·30	9·23	4·91	10·37	10·51	10·44	9·71	3·18	4·28	81·01
Georgetown	Windward (North) ...	4·24	2·47	4·58	5·93	3·72	3·70	7·91	11·45	9·17	7·96	2·09	6·89	70·11
Ratho Mill	do. (South) ..	2·22	0·64	3·80	6·16	6·63	2·93	9·05	9·87	8·04	8·40	2·65	1·72	62·11
Bequia	Grenadines (North) ...	1·14	1·53	2·75	7·33	6·05	2·35	9·16	7·74	8·51	3·27	2·46	1·92	54·21
Peter's Hope	Leeward (Middle) ...	0·92	1·53	5·47	10·40	8·85	3·54	8·45	8·79	—	4·22	1·81	5·08	59·06
Villa Point	Windward (South) ...	2·66	1·33	4·12	6·23	7·31	2·81	9·30	3·96	7·36	8·34	1·87	2·78	58·07
	Total ...	19·06	12·07	32·75	52·14	51·38	26·59	65·75	63·23	55·45	52·95	18·35	29·75	479·47

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No. 2.

HONG KONG.

REPORT FOR THE YEAR 1913, ON THE PREVENTION OF MOSQUITO-BORNE DISEASES.

(Received 26th March, 1914.)

1. Hong Kong.
2. Area :—
   Island of Hong Kong, 32 square miles.
   Kowloon, 16 square miles.
   New territories, 356 square miles (not included under any of the following statistics—wholly agricultural).
3. Census population, 20th May, 1911 :—

Europeans	10,708
East Indians	4,066
Chinese and Malays	354,739
Mixed and coloured	3,608
	373,121
Estimated population to 30th June, 1912	398,520

4. Births :—

Non-Chinese	339
Chinese	3,392

5. Total deaths 8,435

Deaths ascribed to malarial fever	290
Deaths ascribed to blackwater fever	0
Deaths ascribed to yellow fever	0

6. (*a*) Civil Hospital (Government) :—

Total admissions for the year	2,793
Total deaths for the year	178
Malarial fever, admissions	236
do. deaths	3
Blackwater fever, admissions	0
do. deaths	0
Yellow fever, admissions	0
do. deaths	0
Filarial diseases, admissions	2
do. deaths	0
Dengue, admissions	12
do. deaths	0

(*b*) Victoria Hospital (Government) :—

Total admissions for the year	224
Total deaths for the year	8
Malarial fever, admissions	43
do. deaths	0
Blackwater fever, admissions	0
do. deaths	0
Yellow fever, admissions	0
do. deaths	0
Filarial diseases, admissions	0
do. deaths	0
Dengue, admissions	6
do. deaths	0

No other Government hospitals except the Infectious Diseases and the Maternity Hospitals.

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The following hospitals are supported by voluntary contributions :—

(*c*) Tung Wah Hospital (Chinese) :—

Total admissions for the year	4,706
Total deaths for the year	1,274
Malarial fever, admissions	145
do. deaths	68
Blackwater fever, admissions	0
do. deaths	0
Yellow fever, admissions	0
do. deaths	0
Filarial diseases, admissions	0
do. deaths	0
Dengue, admissions	0
do. deaths	0

(*d*) Alice Memorial and Affiliated Hospitals (for Chinese) :—

Total admissions for the year	1,634
Total deaths for the year	114
Malarial fever, admissions	25
do. deaths	2
Blackwater fever, admissions	0
do. deaths	0
Yellow fever, admissions	0
do. deaths	0
Filarial diseases, admissions	1
do. deaths	0
Dengue, admissions	0
do. deaths	0

(*e*) Kwong Wah Hospital (for Chinese) Kowloon :—

Total admissions for the year	1,352
Total deaths for the year	441
Malarial fever, admissions	59
do. deaths	24
Blackwater fever, admissions	0
do. deaths	0
Yellow fever, admissions	0
do. deaths	0
Filarial diseases, admissions	0
do. deaths	0
Dengue, admissions	0
do. deaths	0

There are no Government dispensaries, but there are native (Chinese) dispensaries supported by voluntary contributions, and in charge of Chinese doctors trained in Western medicine.

Returns herewith :—

(*a*) Number of such dispensaries	8
(*b*) Total attendances during the year (new cases only)	56,356
(*c*) Attendances for malaria (new cases)	3,610
(*d*) Attendances for filarial diseases	0
(*e*) Attendances for dengue	0

8. Number of Government Medical Officers	11
Number of special Health Officers (including 2 for the Port)	4
Number of other registered practitioners (inclusive of military and naval medical officers)	45

9. Schools :—

(*a*) Number of Government schools	14
Number of State-aided schools	50
(*b*) Number of scholars registered in Government schools	2,692

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Number of scholars registered in State-aided schools	5,367
(*c*) Average daily attendance in Government schools	2,262
Average daily attendance in State-aided schools...	4,198
10. Estates employing indentured labour	none
11. Estimated revenue of the Colony	$7,851,860.00
12. Estimated expenditure of the Colony :—	
(*a*) Total	8,544,906.00
(*b*) Annual medical expenditure	$238,489.00
Annual sanitary expenditure	337,346.00
Total	$575,835.00
(*c*) Upkeep of Government Hospitals.	
Salaries (including Bacteriological Institute)	$93,847.00
Upkeep :—	
Hospitals	78,693.00
Bacteriological Institute	2,928.00
Total ...	$175,468.00
(*d*) Total salaries and allowances of Medical Officers (including Sanitary Department and Bacteriological Institute)	$78,387.00
(*e*) Total annual sanitary expenditure	337,346.00

13. No town under municipal control.

14. Table of Deaths by Districts.

	Population 1913 (including Army and Navy)			Total deaths.												
	Area in square miles.	Chinese.	Non-Chinese.	January	February	March	April	May	June	July	August	September	October	November	December	Total
Victoria and Peak	4½	239,260	10,560	687	267	401	393	468	665	651	550	550	504	380	466	5682
Villages of Hong Kong	27½	15,180	970	19	18	25	38	36	26	14	30	23	25	27	25	306
Kowloon ...	16	68,500	6,810	97	91	106	86	81	119	139	147	107	153	145	132	1403
Harbour ...	—	53,870	3,120	77	39	56	66	74	79	106	147	98	100	90	112	1044
Totals ...	48	376,810	21,460	580	415	588	583	659	889	910	874	778	782	642	735	8435

15. Victoria is the only town, and the figures are given in the foregoing table.

16. Monthly Table of Rainfall.

Where observed.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in inches.
Kowloon Royal Observatory	1·025	2·390	6·945	2·175	9·300	16·035	15·050	10·565	14·570	3·550	0·740	1·385	83·730

17. (*a*) No further legislation has been introduced to prohibit the breeding of mosquitoes; a copy of the by-law in force was sent with the report for 1910.* During the past year 437 notices were served, calling upon householders to cease the breeding of mosquitoes in their premises, but it was not necessary to institute any prosecutions in connexion therewith.

* No. 2 in Appendix I. to [Cd. 6024.]

(b) It has not yet been possible to make any systematic spleen examinations of children outside the various hospitals, for reasons given in the previous reports. Kala-azar does not exist in the Colony.

(c) Filarial disease is uncommon in Hong Kong; frequent blood examinations are made in all the hospitals in search of these parasites.

(d) The training of nullahs in the vicinity of the City is still in progress, and during 1913 the sum of $18,140 was spent on this work. The total length of trained nullahs and cement channels built since the commencement of anti-malarial works in the Colony is 11·6 miles.

(e) The staff consists of 21 trained British inspectors, who give their whole time to sanitary work, five rural police who act also as sanitary inspectors, a storekeeper, and 664 interpreters, foremen, artisans, bullock-drivers, scavengers, bargemen, and coolies, whose whole time is occupied in house-cleansing and scavenging, disinfection, clearing brushwood and collecting receptacles for water from the hillsides and waste lands in the neighbourhood of dwellings, in oiling pools, and other sanitary and anti-malarial works.

(f) The amount of quinine issued free during the year was as follows :—

	oz.
Government hospitals	2,200
Tung Wah Hospital	162
Kwong Wah Hospital	74
Alice Memorial and Affiliated Hospitals ...	427
Public dispensaries	553
Total ...	3,416

(g) Quinine has been regularly distributed to certain schools in the most malarious part of the Colony.

(h) There are no estates employing indentured labour.

(i) The question of housing is dealt with in the Public Health and Buildings Ordinance—a copy of which was sent with the report for 1910.

(j) The total deaths from malaria during the past five years have been as follows :

1909	1910	1911	1912	1913
422	591	338	432	290

This represents a ratio per 1,000 of population of :

1·2	1·7	0·9	1·1	0·7

The ratio per 1,000 of admissions to hospital for malaria among the British troops during the past five years has been as follows :—

1909	1910	1911	1912	1913
138·4	177·0	125·5	84·0	42·5

while among the Indian troops the ratios were :—

1909	1910	1911	1912	1913
54·3	89·8	31·8	83·2	83·9

As explained in previous reports, the military figures constitute probably the most accurate test of the progress of our anti-malarial works, since they comprise that portion of the population which is under constant medical supervision; even these figures are, however, liable to some fluctuation, depending on the healthiness or otherwise of the last station occupied by the troops. The civilian figures are liable to far more violent fluctuations on account of the changing nature of the native population; there is a daily ebb and flow of nearly 4,000 Chinese between Hong Kong and the mainland of China, and, in addition, the Colony has been liable of late to periodical inroads of large numbers of people, who have been disturbed by the political unrest prevailing in that country. During 1911 and 1912 some 40,000 to 50,000 people sought refuge in Hong Kong during the rebellion which led to the establishment of the republic, and in 1913 a further influx of a like number of persons occurred during the months of July, August, and September, in consequence of renewed political disturbances.

That the malarial figures show so marked a reduction, in spite of these adverse circumstances is, I think, a matter for congratulation, and, were it possible to take into account the increase of population which is the result of these temporary incursions, the improvement would be found to be more marked than it appears at first sight. The demand for housing accommodation during the past two years has been abnormal, and no less than 335 new dwellings were completed during 1913.

Special classes are held in all the schools of the Colony for instruction in hygiene, which includes a description of the part played by mosquitoes in the spread of malaria, and mosquito larvæ in jars covered with mosquito netting are supplied to all the schools, on application, for demonstration purposes.

A considerable quantity of literature on this subject—both in English and Chinese—is also distributed yearly to the community.

FRANCIS CLARK, M.D., M.R.C.P., D.P.H.,
Medical Officer of Health.

24th February, 1914.

No. 3.

BRITISH SOLOMON ISLANDS PROTECTORATE.

REPORT FOR THE YEAR 1912 ON THE PREVENTION OF MOSQUITO-BORNE DISEASES.

(Received 4th May, 1914.)

1.	Name of Colony: British Solomon Islands Protectorate.	
2.	Total area: 9,500,000 acres.	
3.	Estimated population:—	
	(a) Total	150,443
	(b) Europeans	307
	(c) Natives	150,000
	(d) Other races	136
4.	Births during the year:—	
	(a) Europeans	0
	(b) Natives	Not known
5.	Deaths during the year:—	
	(a) Total deaths	8 (Among non-native population). Not known among native population.
	(b) Deaths ascribed to fever	4
	(c) Deaths ascribed to blackwater fever ...	1
	(d) Deaths ascribed to yellow fever ...	0
6.	Government hospitals:—	
	(a) Number of such hospitals	1
	(A temporary building made of leaf, and is for natives only)	
	(b) Totals during the year. Admissions ...	35
	Deaths ...	3
	(c) Malarial fever. Admissions ...	5
	Deaths ...	0
	(d) Blackwater fever. Admissions ...	0
	(e) Yellow fever. " ...	0
	(f) Filarial diseases. " ...	0
	(g) Dengue. " ...	0
7.	Government dispensaries	0
8.	Medical service:—	
	(a) Number of Government Medical Officers	1
	(b) Number of Special Health Officers ...	0
	(c) Number of other registered practitioners	3
9.	Government and State-aided schools ...	0
10.	Estates employing indentured labour:—	
	(a) Number of such	117
	(b) Number of indentured labourers employed	3,683

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(c) Number of hospitals and dispensaries on such estates	Not known
(d) Total deaths among such labourers ...	99 (reported)
(e) Deaths ascribed to malaria	Not known
(f) Total admissions and attendances at hospitals and dispensaries	Not known
11. Estimated revenue of Colony:—	
Total during the year	£19,580 (financial year)
12. Estimated expenditure of Colony:—	
(a) Total during the year	£22,987 (financial year)
(b) Annual medical and sanitary expenditure	£520
(c) Upkeep of Government hospitals and dispensaries	£110
(d) Total salaries and allowances of Medical Officers	£410
(e) Total annual sanitary expenditure ...	nil
13. Towns under Municipalities or Town Councils	0
14. Table of deaths by districts	Not known
15. Table of deaths in the principal towns ...	No towns

16. Rainfall during the year:—

Where observed. Tulagi.

January	14·03
February	6·27
March	9·36
April	6·81
May	6·24
June	7·88
July	4·14
August	7·08
September	5·53
October	10·57
November	8·13
December	4·30
Total	90·36 inches

17. Additional information to be given, if possible, on the following points:—

(a) Is there any legislation in force against the breeding of mosquitoes in premises? No.

(b) Number of children examined for enlarged spleen. None.
Does kala-azar exist? No known cases.

(c) Number of persons examined for filarial diseases. No systematic examination.

(d) Any large works for surface drainage of towns or reclamation of marshes. None.

(e) Number of men employed in towns and villages for petty anti-mosquito works. None.

(f) Amount of Government quinine sold or distributed gratis during the year. Quinine distributed gratis to Government Officials only and to natives employed by the Government. Amount: 6,000 5-grain tabloids (approximate) and about 30 ounces Pulv: Quin. distributed gratis.

(g) Is quinine distributed regularly in the schools? There are no Government schools.

(h) Measures taken against these diseases on estates employing indentured labour. As far as is known the use of mosquito nets.

(i) Any steps taken regarding the housing of the poor. No poor to be housed.

(j) Any exceptional increase or decrease of these diseases recently noticed. No marked changes.

G. C. M. DAVIES,
Government Medical Officer.

Tulagi,
1st December, 1913.

APPENDIX I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

No. 4.

BRITISH SOLOMON ISLANDS PROTECTORATE.

REPORT FOR THE YEAR 1913 ON THE PREVENTION OF MOSQUITO-BORNE DISEASES.

(Received 4th May, 1914.)

1. Name of Colony: British Solomon Islands Protectorate.
2. Total area: 9,500,000 acres.
3. Estimated population:—

(*a*) Total	150,475
(*b*) Europeans	320
(*c*) Natives	150,000
(*d*) Other races	155

4. Births during the year:—

(*a*) European	0
(*b*) Half-caste	2
(*c*) Native	Not known

5. Deaths during the year:—

(*a*) Total deaths	13 (European and other races.) Among the natives: Not known.
(*b*) Deaths ascribed to fever	7
(*c*) Deaths ascribed to blackwater fever ...	1
(*d*) Deaths ascribed to yellow fever ...	0

6. Government hospitals:—

(*a*) Number of such hospitals		1
(*b*) Totals during the year. (Since the opening of new hospital six months ago)	Admissions ...	16
	Deaths ...	1
(*c*) Malarial fever.	Admissions ...	4
	Deaths ...	0
(*d*) Blackwater fever.	Admissions ...	0
(*e*) Yellow fever.	,, ...	0
(*f*) Filarial diseases.	,, ...	0
(*g*) Dengue.	,, ...	0

7. Government dispensaries 0
8. Medical service:—

(*a*) Number of Government Medical Officers	1
(*b*) Number of Special Health Officers ...	0
(*c*) Number of other registered practitioners	3

9. Government and State-aided schools ... 0
10. Estates employing indentured labour:—

(*a*) Number of such	129
(*b*) Number of indentured labourers employed	4,400 (approximate)
(*c*) Number of hospitals and dispensaries on such estates	Not known
(*d*) Total deaths among such labourers ...	85 (approximate)
(*e*) Deaths ascribed to malaria	Not known
(*f*) Total admissions and attendances at hospitals and dispensaries	Not known

11. Estimated revenue of Colony:—
    Total during the year ... ... £21,211 (financial year)
12. Estimated expenditure of Colony:—

(*a*) Total during the year	£21,080 8s. 4d. (financial year)
(*b*) Annual medical and sanitary expenditure	£596 8s. 4d.
(*c*) Upkeep of Government hospitals and dispensaries	£171 0s. 0d.

(d) Total salaries and allowances of Medical Officers ... ... £425 8s. 4d.
(e) Total annual sanitary expenditure.

13. Towns under Municipalities or Town Councils 0
14. Table of deaths by districts ... ... Not known
15. Table of deaths in the principal towns ... No towns
16. Rainfall during the year:—

Where observed. Tulagi.

January	17·46
February	4·30
March	14·77
April	8·37
May	7·89
June	7·12
July	8·31
August	5·29
September	7·76
October	4·94
November	1·94
December	3·00
Total	91·15 inches

17. Additional information to be given, if possible, on the following points:—
(a) Is there any legislation in force against the breeding of mosquitoes in premises? No.
(b) Number of children examined for enlarged spleen. None.
Does kala-azar exist? No known cases.
(c) Number of persons examined for filarial diseases. No systematic examination.
(d) Any large works for surface drainage of towns or reclamation of marshes. None.
(e) Number of men employed in towns and villages for petty anti-mosquito works. None.
(f) Amount of Government quinine sold or distributed gratis during the year. Quinine distributed gratis to Government Officials only and to natives employed by the Government.—Amount: 5-grain tabloids No. 6300, and about 24 ounces Pulv: Quin. distributed gratis.
(g) Is quinine distributed regularly in the schools? There are no Government schools.
(h) Measures taken against these diseases on estates employing indentured labour. As far as is known the use of mosquito nets.
(i) Any steps taken regarding the housing of the poor. None.
(j) Any exceptional increase or decrease of these diseases recently noticed. No marked changes.

G. C. M. DAVIES,
Government Medical Officer.

Tulagi,
5th January, 1914.

No. 5.

UGANDA.

RETURN OF STATISTICS ON THE SUBJECT OF THE PREVENTION OF MOSQUITO-BORNE DISEASES FOR THE YEAR ENDING 31ST DECEMBER, 1913.

(Received 23rd May, 1914.)

1. *Name of Colony.*
Uganda Protectorate.
2. *Total Area.*
117,681 square miles (taken from Census Return, April, 1911).

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

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3. *Estimated Population.*

Europeans	823
Asiatics	3,110
Natives	2,889,561
Total	2,893,494

4. *Births.*

Europeans	26
Asiatics	13
Natives	36,284
Total	36,323

5. *Deaths.*

Europeans	9
Asiatics	39
Natives	32,612
Total	32,660

Deaths attributed to fever :—

Europeans	—
Others	5,313
Total	5,313

Deaths attributed to blackwater fever :—

Europeans	2
Others	10
Total	12

Deaths attributed to yellow fever :—

Europeans	Nil
Others	Nil

6. *Government Hospitals.*

(*a*) Number	13

(*b*) Admissions :—

Europeans	40
Asiatics and Natives	1,873
Total	1,913

(*c*) Malarial Fevers :—

Admissions :—

Europeans	18
Asiatics and Natives	205
Total	223

Deaths :—

Europeans	Nil
Asiatics and Natives	5
Total	5

(*d*) Blackwater fever :—

Admissions :—

Europeans	Nil
Asiatics and Natives	4
Total	4

Deaths :—

Europeans	Nil
Asiatics and Natives	1
Total	1

(*e*) Yellow fever	no cases
(*f*) Filarial diseases	5
(*g*) Dengue fever	Nil

7. *Government Dispensaries.*

(*a*) Number of dispensaries	19
(*b*) Total attendances during year	112,624
(*c*) Total attendances for malaria	6,426
(*d*) Total attendances for filarial diseases	39
(*e*) Total attendances for dengue fever	19

8. *Medical Service.*

(*a*) Number of Government Medical Officers :—

1 Principal Medical Officer.
1 Deputy Principal Medical Officer.
1 Medical Sanitary Officer, and
18 Medical Officers.

In addition to above there are three Medical Officers employed on sleeping sickness investigations and four Medical Officers, including three temporary, for dealing specially with venereal diseases.

(*b*) Number of Special Health Officers :—

The Medical Sanitary Officer.

(*c*) Number of other registered practitioners 4

9. *Schools.*

(*a*) Number of Government and State-aided schools :—

There are no Government or specially State-aided schools. Annual educational grants are made to three missionary societies and certain special grants for scholarships, &c.

Number of schools	202
(*b*) Number of scholars registered	26,197
(*c*) Percentage of daily attendance	62·93

10. *Estates Employing Indentured Labour.*

There is no indentured labour on estates in this Protectorate.

11. *Estimated Revenue* £222,256

APPENDIX I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

12. *Estimated Expenditure.*

(*a*) Total during the year	£291,011
(*b*) Annual medical and sanitary expenditure	£12,728
(*c*) Upkeep of Government hospitals and dispensaries	£7,810
(*d*) Total salaries and allowances to Medical Officers	£10,148
(*e*) Total annual sanitary expenditure:— Sanitary service in permanent stations ...	£1,755
Upkeep of stations	£3,192

13. *Towns under Municipalities or Town Councils.*
None, but the following stations were under control of Local Sanitary Committees, consisting of the District Commissioner, the Medical Officer, and the District Engineer, viz.: Entebbe, Kampala, Jinja, Mbale, Mbarara, Hoima, and Masindi.

14. *Table of Deaths by Districts.*
(Attached).

15. *Table of Deaths in Principal Towns.*
Not obtainable.

16. *Rainfall.*
(Table attached).

17. *Additional Information.*
(*a*) Rules are in force at Entebbe, Kampala, Jinja and Mbale under the Township Ordinance giving powers to authorized persons to enter premises for the purpose of seeing that rules under the Ordinance are duly performed and observed, and also others imposing penalties on persons failing to keep their water receptacles free from mosquito larvæ.

Notices, Warnings, Convictions.

Station.	No. of Notices.	No. of Warnings.	No. of Convictions.
Entebbe	78	Nil.	Nil.
Kampala	58	Nil.	Nil.
Jinja	70	Nil.	Nil.
Total	206	Nil.	Nil.

(*b*) *Number of children examined for enlarged spleen.* No record.
(*c*) *Number of persons examined for filarial diseases.* No record.
(*d*) *Any large work for surface drainage of town or reclamation of marshes.*
The work of drainage of swamps in or adjacent to the stations of Kampala, Masindi, Hoima, Mbale and Bukakata have been continued during the year and drainage of marsh-land at Entebbe begun.
(*e*) *Number of men employed in towns and villages for petty anti-mosquito work.*
"Anti-Malarial Gangs" of from 6 to 12 men have been employed at all principal stations. These gangs were supplemented by the station staffs.

(*f*) *Amount of Government quinine sold or distributed gratis during the year. Agencies employed.*

5 gr. tabloids and tablets	73,100
Quinine in powder	180 lbs. 14 ozs.

Agencies employed—Government Dispensaries.

(*g*) *Is quinine distributed regularly in schools?*
No. Only in certain schools when children have fever.

(*h*) *Measures taken against these diseases.*
Employment of anti-mosquito gangs in townships, periodical inspection of compounds for empty tins, broken bottles, clearing of rain-gutters, &c., clearance of long grass, planting of short "French" grass, inspection of water vessels for larvæ, improved gauze wire protection of houses, instruction of Military and Police in anti-mosquito work and the distribution of anti-mosquito literature and reclamation of swamps. No measures taken outside township.

(*i*) *Housing of the poor.*
No measures.

(*j*) *Any exceptional increase or decrease of these diseases recently noticed.*
There has been a marked increase in the number of blackwater fever cases (particularly at Kampala).

(*k*) Any further information which may become available will be embodied in the Annual Medical and Sanitary Report for 1913.

A. D. P. HODGES,
Principal Medical Officer, Uganda Protectorate.

Entebbe, Uganda.
23rd April, 1914.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

Return showing Deaths among Europeans, Asiatics, and Natives, each month during 1913, by Districts.

District.	Area in Square Miles.	Population.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Buganda	21,366	696,688	1,066	1,021	902	1,006	948	1,014	1,077	1,185	1,014	956	933	892	12,014
Eastern Province	32,022	1,110,189	553	586	686	609	489	671	817	798	704	636	728	615	7,892
Bunyoro	8,244	130,922	332	369	396	476	727	438	626	577	598	491	424	565	6,019
Toro	5,760	115,041	178	139	136	149	220	338	258	255	188	201	169	166	2,397
Ankole	4,353	266,700	255	288	269	307	379	368	364	364	524	291	418	414	4,241
S. S. Camp	—	—	10	12	7	4	15	6	11	8	8	8	3	4	96
Unadministered Areas, etc.	45,936	570,021	1	*	*	*	*	*	*	*	*	*	*	*	1
Totals	117,681	2,889,561	2,395	2,415	2,396	2,551	2,778	2,835	3,153	3,187	3,036	2,583	2,675	2,656	32,660

* Returns of native deaths not available.

COMPARATIVE RAINFALL STATEMENT, SHOWING THE MONTHLY RAINFALL FOR THE YEAR 1913 OF 48 LOCALITIES OF THE UGANDA PROTECTORATE.

Month.	Entebbe.		Nimule.		Jinja.		Mbarara.		Masaka.		Gondokoro.		Fort Portal.		Butiaba.		Masindi.		Gulu.		Kampala.		Mbale.	
	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.
January	0·63	7	Nil	Nil	0·61	4	0·10	1	1·35	6	Nil	Nil	1·38	4	0·84	2	0·57	2	0·15	1	2·37	8	0·01	1
February	7·32	15	4·24	4	5·11	9	2·13	12	1·40	10	5·82	2	4·08	10	0·52	1	3·84	9	3·63	10	3·95	15	3·07	11
March	9·51	15	1·12	1	3·27	13	3·14	13	2·08	11	0·21	2	5·32	7	1·62	3	3·36	9	1·83	6	7·68	15	4·14	4
April	12·71	25	6·28	10	8·15	18	1·80	5	6·58	16	3·41	12	6·24	17	3·25	8	5·34	13	7·13	21	10·16	24	9·81	23
May	10·64	26	7·56	10	8·01	20	2·24	10	4·59	17	3·16	9	5·83	20	3·21	6	5·48	14	6·85	23	5·06	20	6·54	28
June	0·97	10	5·68	6	0·80	5	1·65	4	0·93	8	2·78	7	6·27	16	3·95	9	11·54	11	5·86	13	2·17	13	7·55	18
July	3·22	6	6·83	5	2·81	3	0·28	2	0·59	2	2·15	7	0·48	3	0·23	4	2·44	8	4·32	19	2·61	11	3·87	17
August	1·41	6	3·83	3	1·46	4	0·10	2	0·54	4	2·66	7	2·08	7	2·06	8	6·68	13	5·86	15	0·83	7	2·02	11
September...	1·71	5	0·34	1	3·23	8	0·39	4	1·37	4	1·65	4	5·20	11	2·16	6	4·65	6	0·46	6	3·50	8	1·62	8
October	4·42	13	4·58	5	3·44	11	3·48	12	1·57	10	1·66	10	10·54	20	4·76	10	5·42	14	7·66	22	1·78	20	4·58	14
November	0·90	11	6·86	4	2·19	11	4·21	14	3·19	15	0·34	5	5·56	15	4·13	9	4·43	18	3·39	12	2·72	20	2·30	13
December	2·98	10	Nil	Nil	2·45	6	1·41	6	0·89	6	Nil	Nil	0·15	1	0·51	4	1·25	5	1·65	3	2·77	12	1·68	7
Total	56·42	149	47·32	49	41·53	112	20·93	85	25·08	109	23·84	65	53·08	131	27·34	70	55·00	122	48·79	151	45·60	173	47·19	155

Month.	Mubendi.		Budo.		Bukona.		Namenage.		Nabieso.		Kumi.		Hoima.		Namukekera.		Nabumali.		Iganga.		Butiti.		Bukumi.	
	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.
January	1·01	5	2·53	5	0·68	4	0·22	1	Nil	Nil	Nil	Nil	0·40	2	1·87	4	0·04	1	1·53	2	0·61	7	2·63	7
February	6·08	11	3·92	10	5·24	13	2·68	4	4·16	5	6·48	7	5·07	12	2·43	9	2·33	15	4·20	8	4·16	12	1·10	4
March	4·85	9	7·34	12	4·78	14	1·75	4	4·70	5	3·93	8	3·25	13	1·96	10	5·98	21	8·07	10	4·13	8	2·75	7
April	5·77	15	8·69	22	8·60	17	4·96	9	3·73	8	5·74	12	5·92	20	5·26	16	11·52	25	6·56	7	3·38	13	5·68	13
May	2·87	9	3·83	13	8·46	28	4·77	10	6·04	10	12·49	20	4·38	21	2·17	—	6·98	29	11·21	17	3·28	16	4·20	10
June	4·73	9	1·57	4	4·78	15	2·53	4	8·12	7	7·58	16	6·35	15	1·50	8	3·66	23	2·71	6	1·78	10	1·80	7
July	1·44	4	0·92	4	3·68	11	1·27	4	2·25	6	4·76	12	4·01	12	0·45	3	3·57	19	2·55	6	3·02	8	1·69	6
August	4·22	7	2·27	6	2·92	12	2·77	7	2·60	4	5·56	7	8·15	16	2·15	8	1·75	21	1·99	7	2·10	7	1·98	5
September...	5·53	11	2·48	5	1·73	10	2·80	6	1·36	3	0·80	3	4·05	13	2·98	5	1·37	11	3·99	7	2·32	10	4·24	11
October	5·06	16	2·65	9	5·87	18	5·32	8	10·25	11	7·63	14	7·85	14	6·07	18	2·11	18	5·09	15	5·01	16	4·08	14
November	1·75	8	3·99	8	3·44	15	2·56	7	3·92	9	5·06	10	4·17	16	2·45	12	2·89	18	2·97	7	3·32	12	1·97	10
December	0·58	6	2·95	7	2·51	8	1·36	3	Nil	Nil	0·17	1	1·65	6	3·64	7	1·90	8	1·68	6	1·89	11	0·95	2
Total	43·89	110	43·14	105	52·69	165	32·99	67	47·13	68	60·20	110	55·25	160	32·93	100	44·10	209	52·55	98	35·00	130	33·07	96

Appendix I.

Month.	Rubaga.		Ngora.		Kisubi.		Kivuvu.		Kawalongojo.		Magigye.		Nandere.		Moniko.		Keritia.		Bombo.		Bwavu.		Bugalla Island (*Sesse*).	
	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.
January	2·54	5	Nil	Nil	1·15	4	1·21	2	1·76	6	0·28	2	0·46	3	2·49	6	2·45	6	0·07	1	4·24	10	3·49	11
February	5·71	9	3·38	6	4·80	12	5·23	11	5·01	13	3·67	8	4·73	12	3·48	7	4·37	14	4·22	11	6·23	14	7·35	18
March	9·23	11	3·58	8	6·85	11	6·72	13	6·27	13	4·95	10	4·90	11	4·94	11	5·91	14	2·20	7	6·78	12	—	—
April	9·08	16	8·79	16	15·12	21	7·15	19	—	—	5·93	17	5·82	17	7·02	15	9·61	19	2·57	14	8·79	18	—	—
May	4·18	11	8·22	19	10·04	19	5·43	18	3·45	23	4·85	16	7·88	18	6·29	17	7·42	16	2·52	17	4·74	19	—	—
June	1·27	4	10·44	12	0·55	5	2·43	7	2·35	11	2·03	8	3·02	13	0·50	3	0·13	1	0·22	6	2·25	16	—	—
July	1·11	—	3·18	—	2·91	9	2·36	6	Nil	Nil	1·37	5	2·48	10	2·40	7	2·08	3	1·21	9	4·70	5	—	—
August	1·31	4	2·12	—	0·71	5	1·17	5	3·15	11	0·77	5	2·33	10	2·97	6	1·97	5	1·25	9	1·26	7	—	—
September...	3·88	8	1·98	—	1·72	5	3·83	10	4·47	11	3·24	11	2·43	11	3·41	11	5·46	8	2·36	10	3·19	8	—	—
October	1·47	8	7·46	—	2·15	9	4·10	14	6·20	17	4·34	19	5·48	15	3·88	13	5·55	14	3·94	16	3·81	20	—	—
November	2·46	14	4·60	—	4·10	4	2·02	13	2·68	10	2·95	14	2·81	12	5·73	15	4·29	10	1·40	10	2·50	13	—	—
December	2·21	8	0·06	1	2·29	7	4·61	13	3·57	10	2·23	11	1·74	10	4·25	10	4·43	9	2·20	8	2·53	9	—	—
Total	44·45	98	53·81	62	52·39	111	46·26	131	38·91	125	36·61	126	44·08	142	47·36	121	53·67	119	24·16	118	51·02	151	10·84	29

Month.	Sango Bay.		Mvuba.		Kakumiro.		Bunyaruguru.		Katigondo.		Kabyaza.		Kadoma		Kitumbuzi.		Kitalya.		Masindi Port.		Lugombe.		Nambeya (*Bulemezi*).	
	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.	In.	No. of days.
January	—	—	—	—	1·71	4	1·37	6	1·62	6	—	—	—	—	1·15	3	—	—	0·08	1	0·23	1	—	—
February	1·34	7	—	—	2·85	9	4·19	17	4·88	15	—	—	—	—	6·22	13	—	—	1·79	9	2·15	6	—	—
March	6·45	7	—	—	3·91	9	3·90	11	4·16	12	—	—	—	—	5·80	12	—	—	6·76	15	4·42	8	—	—
April	14·02	17	—	—	7·16	20	7·26	23	5·80	18	—	—	—	—	7·74	16	—	—	3·44	16	6·44	11	—	—
May	11·20	20	4·38	8	2·12	11	8·63	24	6·22	18	—	—	—	—	10·90	29	—	—	3·89	14	4·10	13	—	—
June	1·74	4	—	—	—	—	2·60	12	1·81	5	2·77	10	4·02	11	6·52	15	—	—	5·29	9	4·18	7	—	—
July	Nil	Nil	—	—	1·29	8	2·78	6	0·50	2	2·57	19	1·65	8	1·34	7	1·78	7	3·43	7	—	—	—	—
August	0·39	2	—	—	2·48	9	1·30	7	1·03	2	2·53	9	3·06	13	3·19	9	2·88	9	0·96	4	—	—	—	—
September...	1·21	3	—	—	4·37	9	4·25	14	0·58	5	4·76	12	1·04	10	0·68	6	4·73	9	1·24	5	—	—	—	—
October	2·73	7	—	—	6·49	15	7·25	17	2·41	10	3·58	13	4·92	17	5·77	15	7·65	14	—	—	—	—	3·69	17
November	4·14	12	—	—	3·13	13	4·33	10	3·69	9	4·51	23	4·59	16	3·60	16	3·15	13	—	—	—	—	2·18	8
December	3·55	4	—	—	0·14	2	0·67	4	1·56	7	1·92	10	2·24	11	2·15	9	2·68	9	—	—	—	—	—	—
Total	46·77	83	4·38	8	35·65	109	48·53	151	34·26	109	22·64	96	21·52	86	55·06	150	22·87	61	26·88	80	21·52	46	5·87	25

W. R. Rutter,
Chief Forestry Officer.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

No. 6.

SOUTH AFRICA.

The HIGH COMMISSIONER to the SECRETARY OF STATE.

(Received 26th May, 1914.)

Sir, High Commissioner's Office, Cape Town, 9th May, 1914.

I have the honour to enclose, for your information, copies of despatches from the Resident Commissioner, Swaziland, and the Administrator, Southern Rhodesia, on the subject of mosquito-borne diseases.

I have, &c.,
GLADSTONE,
High Commissioner.

Enclosure 1 in No. 6.

Resident Commissioner's Office, Mbabane, Swaziland,
My Lord, 2nd January, 1914.

With reference to Your Excellency's despatch of 19th January, 1911, on the subject of the prevention of mosquito-borne diseases, I have the honour to state that no reliable statistics can be furnished in regard to Swaziland, as required by the Circular despatch from the Right Honourable the Secretary of State for the Colonies, dated 20th December, 1910. Very few Europeans live in the low malarial areas and amongst the natives the disease is endemic, and, in ordinary years, takes a mild form. Births and deaths of natives are not registered in Swaziland.

2. Pamphlets and posters dealing with the cause and prevention of malaria have been distributed amongst the European population, and both European and native schools have been supplied with cards and pamphlets bearing on these subjects. A supply of quinine and other medicines is kept at each station and is issued free to natives on application; they do not, however, avail themselves of this as a rule.

I have, &c.,
R. T. Coryndon,
Resident Commissioner.

His Excellency
The Right Honourable
Viscount Gladstone, P.C., G.C.M.G.,
High Commissioner for South Africa.

Enclosure 2 in No. 6.

My Lord, Administrator's Office, Salisbury, 29th April, 1914.

With reference to Your Lordship's despatch of the 6th March, I have the honour to transmit a report on the subject of mosquito-borne diseases in Southern Rhodesia for the year 1913.

I also enclose a series of the literature* which has been distributed by the Medical Department in the course of the educational campaign which is being conducted.

I have, &c.,
W. H. Milton,
Administrator.

His Excellency
The High Commissioner,
Cape Town.

Mosquito-Borne Diseases, Southern Rhodesia, 1913.

Malaria, blackwater fever, and dysentery were responsible for 79 deaths, or 24·23 per cent. of the total.

The mortality from mosquito-borne diseases, so far as they affect Europeans, was confined to malaria and blackwater fever. There were 30 deaths registered as caused by malaria, and 34 from blackwater, compared with 22 from malaria and 36

* Not reprinted.

from blackwater in 1912. In 1912, out of the total deaths recorded, 6·45 per cent. were due to malaria and 10·56 per cent. to blackwater, whilst in 1913 out of the total deaths registered 9·20 per cent. were due to malaria and 10·46 to blackwater. A better conception of the mortality from these causes can, however, be gained by comparison of the mortality rates with the population.

—	Malaria.		Blackwater.	
	Deaths.	Death Rate per cent. of Population.	Deaths.	Death Rate per cent. of Population.
1912 ...	22	0·08 per cent.	36	0·13 per cent.
1913 ...	30	0·09 per cent.	34	0·11 per cent.

The mortality from these diseases has remained nearly stationary for two years, whilst the rural, or most exposed, section of the community, have been increasing, presuming a relative decrease. In the absence of definite statistics as to the increase in the rural population we are not in a position to show to what extent this decrease has occurred.

Malaria.—There were 779 persons admitted to hospital in Southern Rhodesia during 1913 suffering from malaria, of which 13 died, giving a case mortality of 1·67 per cent., as compared with 770 cases in 1912 and 6 deaths, with a case mortality of 0·78 per cent. The largest number of admissions was at Umtali, where 263 Europeans were admitted during the year; a large proportion of these, however, were not resident in Southern Rhodesia, but came from the adjacent Portuguese territory. There were 241 native admissions with 5 deaths, a case mortality of 2·07 per cent.

These hospital admissions in no way represent the malarial incidence in the country generally, as the larger proportion of cases of malaria are treated in their own homes or on the veldt, and frequently without medical intervention of any sort or description.

Blackwater.—There were 57 admissions on account of blackwater fever as compared with 60 in 1912. Of these 14 died, giving a mortality rate of 24·56 per cent., somewhat lower than in the former year, when the mortality rate was 28·33 per cent. Four cases of blackwater fever in natives were notified, but with one exception these were Asiatics and not indigenous natives of South Africa. The one case of blackwater fever in an indigenous native was reported from Gwanda, he being a native of Nyasaland. Blackwater fever in indigenous natives is so rarely met with as to be considered almost non-existent.

The following table is of interest, showing, as it does, the prevalence of blackwater in relation to the population during the last ten years. It will be noted that, though the morbidity varies little, there has been a decided reduction in the case incidence in relation to the population during the last three years as compared with the first four years of this decennial period.

RETURN SHOWING THE CASE INCIDENCE OF BLACKWATER FEVER AMONG EUROPEANS, AS TAKEN FROM THE HOSPITAL ADMISSIONS FOR THE YEARS 1904-13.

Year.	Estimated Population.	Number of Cases.	Case Mortality Rate per cent.	Case Incidence Rate per 1,000 of the Population.
1904	12,623	38	23·68	3·01
1905	12,596	61	16·39	4·84
1906	14,524	73	23·28	5·03
1907	14,007	57	22·80	4·07
1908	14,640	41	29·27	2·80
1909	Not estimated.	75	24·00	—
1910	" "	75	22·66	—
1911	23,606	39	17·95	1·65
1912	26,896	60	28·33	2·23
1913	30,344	57	24·56	1·88

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

The relation of malaria and blackwater fever both to each other and to the rainfall is graphically shown in the chart appended. The height of the blackwater curve follows some 30 days after the height of the malarial, which latter reached its maximum in May and dropped away very rapidly in June and July. The relation of the malarial curve to the rainfall is even more interesting. Commencing to rise some 30 days after the advent of the early rains, it reached the maximum in May, approximately three months after the highest rainfall and almost following on the cessation of the rains, when the pools and water-courses ceased to be washed with torrential storms and mosquito larvæ had a chance to develop into the adult mosquito.

Both malaria and blackwater fever have, in the course of the year, aroused a considerable amount of public interest and anxiety, especially in the Mazoe, Lomogundi, and Abercorn districts. This is only to be expected when we consider the forward movement which has taken place in the last two or three years in the settlement of rural districts where malaria and its sequelæ are most rife, and where new settlers are especially exposed to infection.

There has been the usual flood of letters in the papers, criticisms of the Administrative methods, and suggestions of quaint cures and nostrums. Many of these communications to the Press were calculated to do infinite harm, as they were written largely by ignorant persons to an ignorant people; at the same time it must be admitted that the awakening of public interest in questions so vitally concerned with the beneficial occupation of the country could not be otherwise than a blessing. Attention was thereby directed to the most recent theories and the results of scientific research into the cause and prevention both of malaria and blackwater, and it has been possible to demonstrate to the thinking portion of the population how mosquito-borne diseases can not only be combated, but can easily, efficiently, and economically be prevented.

This campaign of education has been strenuously pushed forward by the Administration during the year. Lectures have been given, articles inserted in the local Press, and pamphlets widely distributed, dealing with these diseases and their prevention. The country was specially fortunate in the visits of two such eminent authorities as Sir Patrick Manson, G.C.M.G., late Medical Adviser to the Colonial Office, and General Gorgas, the Chief Sanitary Officer of the Panama zone.

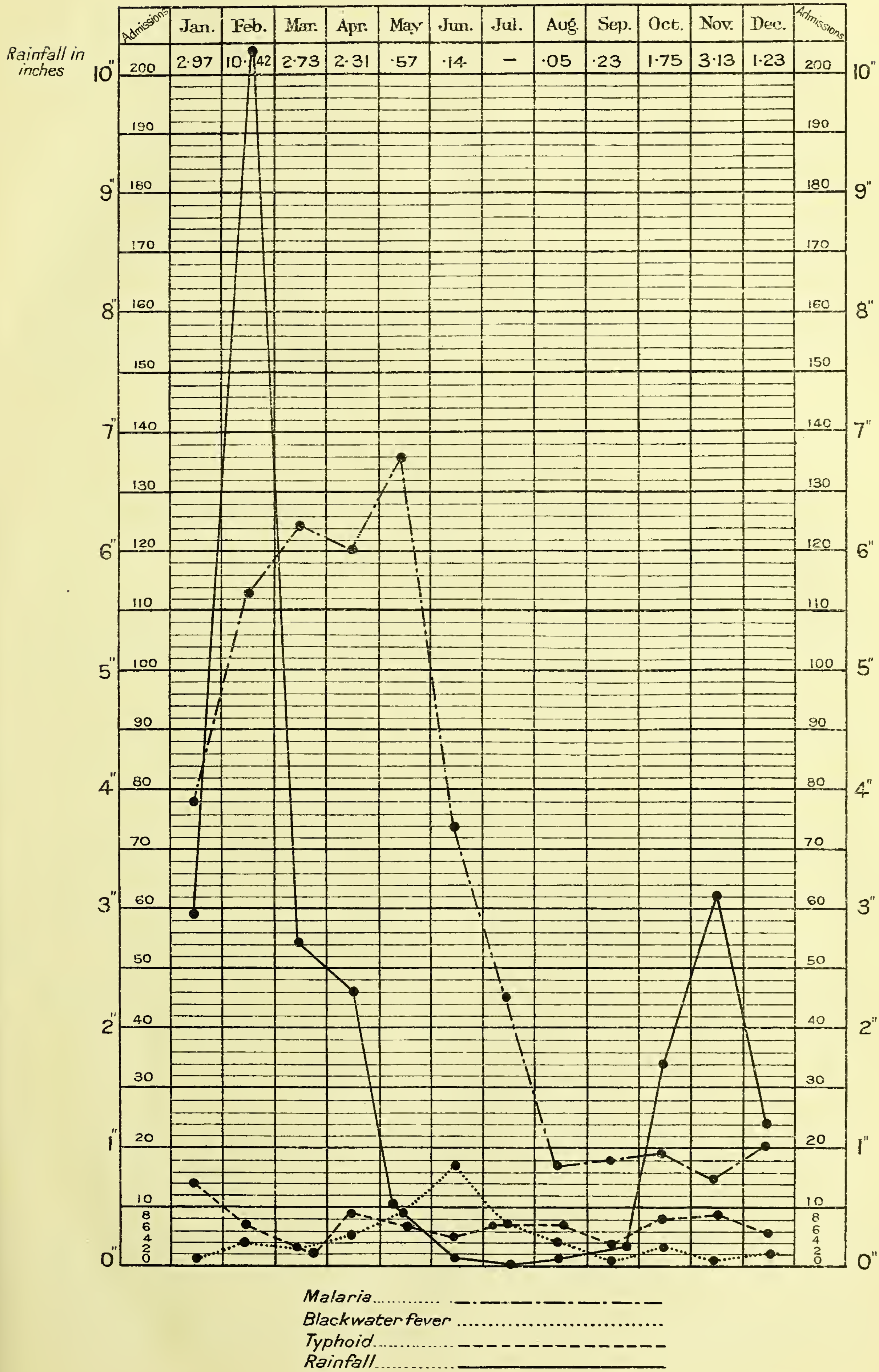
Sir Patrick Manson, who was on a private visit to the country, kindly addressed the people in Bulawayo, and copies of his lecture have been printed and widely distributed. General Gorgas, who came to Johannesburg at the end of 1913, at the request of the Transvaal Chamber of Mines, to advise on health and sanitation in native mine compounds, was asked by this Administration to extend his visit to Southern Rhodesia, and to advise this Administration especially with regard to the prevention of malaria and blackwater.

General Gorgas, it is true, did not arrive in Southern Rhodesia till February, 1914, but, as his visit was in reality a continuation of the scheme of general education of the public in matters relating to the health of the community, and the breaking down if possible of popular prejudices, it is convenient here to refer to the conclusions he arrived at as a result of his investigations on the spot. These were embodied in a report to the Administration which, as well as being published in the Press, was printed in pamphlet form and widely distributed. In advising the Administration as to the methods to be adopted by the Government for the prevention of mosquito-borne diseases, General Gorgas was most insistent on the value of education, and in this connexion the following extract is taken from his report:

"The Government should continue the present campaign of education. Over such a large area of country no sanitary work can be successful against malaria till the people believe in its efficiency. Education is the great means for bringing this about." An opinion frequently expressed and given particular publicity to in some quarters was that in blackwater we had a disease which was peculiar to this country, and that little was known about its cause or prevention. The remarks, both of General Gorgas and of Sir Patrick Manson, should go far to dispel this popular fallacy.

Attention was drawn in the report for 1912 to the necessity for special research into local diseases affecting both Europeans and natives. This matter is now receiving the attention of the Administration, and it is hoped that a special research

CHART SHEWING NUMBER OF CASES OF MALARIA, TYPHOID, & BLACKWATER FEVER, ADMITTED TO HOSPITALS, WITH RAINFALL IN RHODESIA DURING YEAR ENDED 31ST DECEMBER, 1913.



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scholar may shortly be appointed to work on the human diseases occurring in this country, which will include the study of blackwater.

It is sincerely to be hoped, however, that the public will not make this an excuse for waiting idly for the problematical results of such research when they have at hand simple and effective methods for preventing the diseases which trouble them.

Residents in rural districts are most affected with malaria and blackwater, as is to be expected, little malaria occurring in urban areas. The parts of the country most affected were apparently the rich valleys and areas where the altitude was under 3,500 feet, though both malaria and blackwater were met with in practically every district. What is required in this connexion is an entomological survey of the country with special reference to the distribution of the various varieties of anophelines found and their relationship to malaria and blackwater. Such a survey would also help to throw light on the cause and the consequent prevention of these diseases in particular localities. As districts, however, become more populated, as land comes under cultivation, and as persons acquire both the means and the common sense to erect houses constructed in conformity with climatic conditions, there is little doubt that both malaria and blackwater will tend to disappear.

No. 7.

SOUTH AFRICA.

The HIGH COMMISSIONER to the SECRETARY OF STATE.

(Received 18th December, 1914.)

High Commissioner's Office, Pretoria,
25th November, 1914.

Sir,

With reference to Lord Gladstone's despatch of 9th May,* I have the honour to enclose, for your information, a copy of a despatch from the Administrator, Northern Rhodesia, on the subject of mosquito-borne diseases.

I have, &c.,
BUXTON,
High Commissioner.

Enclosure in No. 7.

Administrator's Office, Livingstone, Northern Rhodesia,
9th November, 1914.

My Lord,

With further reference to Your Lordship's despatch of 13th October, on the subject of mosquito-borne disease, I now have the honour to forward, for Your Lordship's information, a copy of report for the year ending 31st March, 1914.

I have, &c.,
L. A. Wallace,
Administrator.

His Excellency
The High Commissioner for South Africa,
Pretoria.

Mosquito-Borne Diseases.

Report for Year ending 31st March, 1914.

The only diseases coming under this heading in Northern Rhodesia are malaria, blackwater fever, and filariasis.

Of these the first named is by far the most common, both in Europeans and natives. Blackwater fever is confined to Europeans. Although occasionally odd cases have been reported in natives, no definite diagnosis of such has been made by medical officers. The ratio of blackwater to malaria in cases coming under treatment in Europeans was, during the past year, as 1 to 7·5, but it must be understood that, whereas practically all cases of blackwater within reach of medical aid

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* No. 6.

come under treatment, only a relatively small proportion of malaria, representing the more severe attacks, do likewise.

Filariasis has not been noticed in any Europeans, but it is fairly common amongst natives.

Malaria Prophylaxis.—The European population use quinine very regularly as a prophylactic, and a scheme is under consideration for the supply of this drug by the Administration at lowest possible rates.

Amongst certain sections of natives in Government employment—prisons, schools, etc.—quinine is also used, but not amongst the general population, although free medical treatment is accorded every native applying for same.

In connexion with this report certain questions are asked and such as are applicable to this territory are answered below:—

1. Name of Colony: Northern Rhodesia.
2. Total area: 290,000 square miles.
3. Estimated population: (*a*) Europeans, 2,300; (*b*) Natives, 900,000.
4. Births during year: Europeans, 44.
5. Deaths during year: (*a*) Total deaths, 43; (*b*) Ascribed to malaria, 6; (*c*) Ascribed to blackwater, 14.
6. Number of Government Hospitals: (*a*) European, 3; (*b*) Native, 12.

European Hospitals.

—	Admissions.	Malaria.	Deaths.	Blackwater.	Deaths.	Deaths from all Causes.
Livingstone	171	68	1	11	2	6
Broken Hill	61	27	Nil	5	Nil	Nil
Fort Jameson ..	11	2	Nil	2	Nil	Nil

The following figures show the number of natives coming under treatment in hospitals at different stations in Northern Rhodesia:—

—	Numbers Treated.	Malaria.	Deaths.	Filariasis.	Deaths from all Causes.
Livingstone	277	37	4	—	46
Broken Hill	272	17	Nil	14	22
Ndola	461	85	Nil	—	8
Bwana M'Kubwa ...	1,284	124	Nil	—	21
Mpika...	169	7	Nil	—	2
Kawambwa	191	46	1	—	4
Fort Jameson ...	109	7	Nil	—	12
Fundu	601	1	Nil	—	5

It will be seen that, out of 324 cases treated, six deaths occurred, a case mortality of 1·85 per cent. It must be borne in mind that a native rarely seeks treatment for malaria unless it is of a very severe type.

8. *Medical Service*: Number of Government medical officers, 18; number of other registered practitioners, 5 (?).

9. *European Schools*, 1: Average daily attendance, 12; number of scholars registered, 15.

Native Schools: One state-aided. There is a large number of native schools under the direction of various mission societies. No figures are available from these.

10. Estates employing indentured labour:—
    Mining companies employing indentured labour, 2.
    Number of hospitals on such estates, 2.
    Number of labourers employed, approximately 800.
    Total deaths among such labourers, figures unavailable.
    Deaths ascribed to malaria, not known.
    Total admissions to hospitals, 1,284 at one.
    Total admissions to hospitals for malaria, 124 at one.

11. Total revenue, £127,299; estimated expenditure, £189,068.

12. Upkeep of Government hospitals and dispensaries, £7,312; total salaries and allowances of medical officers, £8,682.

13. Towns under municipalities or town councils, 2.

14. Total population (European): approximately, 2,300.

15. Total population (native): approximately, 900,000.

16. Local regulations are in force to prevent the breeding of mosquitoes in townships. Kala azar is not known to exist.

No. 8.

LEEWARD ISLANDS.

RETURNS OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1ST JANUARY TO THE 31ST DECEMBER, 1913.

(Received 26th May, 1914.)

ANTIGUA.

1. Name of Colony	Antigua.
2. Total area	108 sq. miles.
3. Estimated population:—	
(a) Total	31,184 (as at 1st January, 1913)
(b) Europeans	1,013 (census, 1911)
(c)	
(d) Other races	31,252 (census, 1911)
(e)	
4. Births during the year:—	
Total births	1,078
5. Deaths during the year:—	
(a) Total deaths	779
(b) Deaths ascribed to fever	13
(c) Deaths ascribed to blackwater fever	None
(d) Deaths ascribed to yellow fever	None
6. Government hospitals:—	
(a) Number of such hospitals	1
(b) Totals, during year	
admissions	1,057
deaths ...	126
(c) Malarial fever	
admissions	10
deaths ..	2
(d) Blackwater fever	
admissions	—
deaths ...	—
(e) Yellow fever	
admissions	—
deaths ...	—
(f) Filarial diseases	
admissions	13
deaths ...	2
(g) Dengue	
admissions	—
deaths ...	—

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

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7. Government dispensaries:—
   (a) Number of such dispensaries
   (b) Total attendances during year
   (c) Attendances for malaria
   (d) Attendances for filarial diseases
   (e) Attendances for dengue
   } None.

8. Medical Service:—

(a) Number of Government Medical Officers ...	6
(b) Number of special Health Officers ...	—
(c) Number of other registered practitioners ...	2

9. Schools:—

(a) Number of Government and State-aided Schools	27
(b) Number of scholars registered in these schools	6,063
(c) Percentage of daily attendances	52·3

10. Estates employing indentured labour:—
   (a) Number of such... ...
   (b) Number of indentured labourers employed ...
   (c) Number of hospitals and dispensaries on such estates ... ...
   (d) Total deaths among such labourers ... ...
   (e) Deaths ascribed to malaria
   (f) Total admissions and attendances at hospitals and dispensaries ...
   } No such estates.

11. Estimated revenue of Colony:—

	£	s.	d.
Total during year 1912-13	£53,489	9	8

12. Estimated expenditure of Colony:—

	£	s.	d.
(a) Total during year 1912-13	£53,193	7	7
(b) Annual medical and sanitary expenditure	9,839	10	3
(c) Upkeep of Government hospitals and dispensaries	7,505	15	9
(d) Total salaries and allowances of Medical Officers	1,620	0	0
(e) Total annual sanitary expenditure ...	478	12	7

13. Towns under Municipalities or Town Councils:—

(a) Number of such	One		
(b) Total population	7,910		
(c) Total revenues	£2,044	18	9
(d) Total medical and sanitary expenditure ...	930	18	5

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

14. Table of deaths by districts: —

District.	Area. Square miles.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
St. John ...	28·33	14,175	87	39	49	44	19	25	40	22	26	47	34	38	470
St. Mary ...	22·110	4,276	7	6	2	6	3	4	7	4	4	5	2	10	60
St. Paul ...	18·421	4,317	11	7	4	11	2	2	6	6	4	4	5	10	72
St. Philip ...	17·1	2,972	9	3	7	3	4	1	3	7	4	8	4	8	61
St. Peter ...	12·630	2,827	14	8	4	4	2	1	3	6	4	5	—	8	59
St. George ...	9·240	2,827	9	2	—	5	1	5	3	3	2	4	5	7	46
Barbuda ...	62·0	871	1	1	—	—	—	1	1	1	4	1	1	—	11
Total ...	170·155	32,265	138	66	66	73	31	39	63	49	48	74	51	81	779

15. Table of deaths in the principal towns:—

Town.	District where Situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
City of St. John	Parish of St. John	7,910	62	26	36	34	13	20	35	16	21	37	28	29	357

16. Rainfall during the year:—

Where Observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Botanic Station ...	St. John's ...	4·24	1·79	2·85	1·12	10·76	1·75	2·43	5·04	3·47	4·10	3·64	2·80	43·99

17. Additional information to be given if possible on the following points:—
   (*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—Yes.
   Numbers of notices, convictions, and warnings during the year?—Not known.
   (*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does kala-azar exist?—No.
   (*c*) Number of persons examined for filarial diseases. Where was this done? Percentage affected.—25: at the Hospital and Training School at night. 16 per cent.
   (*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost?—No.
   (*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.—28 Sanitary Inspectors. £187 approximate cost.
   (*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed.—£15. Police Stations and Ministers.
   (*g*) Is quinine distributed regularly in the schools?—No.*

* It is intended to introduce the distribution of quinine in primary schools from 1st April, 1914.

(*h*) Measures taken against these diseases on estates employing indentured labour?—No such estates.
(*i*) Any steps taken regarding the housing of the poor?—No.
(*j*) Any exceptional increase or decrease of these diseases recently noticed.—No.
(*k*) Any other remarks on the subject. ———.

St. Kitts-Nevis.

1. Colony of the Leeward Islands (Presidency of St. Kitts-Nevis).
2. Total area:—St. Kitts, 65 square miles. Nevis, 50 square miles. Anguilla, 35 square miles. Total, 150 square miles.
3. Estimated population:—(*a*) Total, 44,279. (*b*) Europeans, 1,580. (*c*) Other races, 42,699.
4. Births during the year:—1,706.
5. Deaths during the year:—

(*a*) Total deaths		1,138
(*b*) Deaths ascribed to fever		16
(*c*) Deaths ascribed to blackwater fever		Nil
(*d*) Deaths ascribed to yellow fever		Nil

6. Government hospitals:—

(*a*) Number of hospitals ...		3
(*b*) Totals during the year	admissions	984
	deaths ...	142
(*c*) Malarial fever	admissions	5
	deaths ...	3
(*d*) Blackwater fever	admissions	Nil
	deaths ...	"
(*e*) Yellow fever	admissions	Nil
	deaths ...	"
(*f*) Filarial diseases	admissions	61
	deaths ...	5
(*g*) Dengue	admissions	Nil
	deaths ...	"

7. Government dispensaries:—

(*a*) Number of such dispensaries	4
(*b*) Total attendances during the year	Not known
(*c*) Attendances for malaria	None
(*d*) Attendances for filarial diseases ...	Not known
(*e*) Attendances for dengue	None

8. Medical Service:—

(*a*) Number of Government Medical Officers ...	9
(*b*) Number of Special Health Officers	None
(*c*) Number of other registered practitioners ...	None

9. Schools :—
   (a) Number of Government and State-aided schools 52
   (b) Number of scholars registered in these schools 9,000
   (c) Percentage of daily attendances ... ... 50 per cent.
10. Estates employing indentured labour ... ... None
11. Estimated revenue of the Presidency ... £52,349
12. Estimated expenditure do. ... £59,844
   (b) Annual medical and sanitary expenditure ... £3,527
   (c) Upkeep Government hospitals and dispensaries ... £5,042
   (d) Total salaries and allowances of Medical Officers £2,340
   (e) Total annual sanitary expenditure £1,186
13. Towns under Municipalities or Town Councils :—
   (a) Number of such ... 1
   (b) Total population ... 8,000
   (c) Total revenues £2,400
   (d) Total medical and sanitary expenditure ... £5,600
14. Table of deaths by districts :—

District.	Area. Square Miles.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June	July.	August.	September.	October.	November.	December.	Total.
St. Kitts ...	65	26,583	67	68	50	57	73	70	53	65	59	59	56	67	744
Nevis ...	50	13,335	51	21	24	16	27	16	20	12	40	31	29	29	316
Anguilla ...	35	4,361	3	10	7	8	7	6	4	5	6	8	7	6	77
Total ...	—	—	121	99	81	81	107	92	77	82	105	98	92	102	1,137

15. Table of deaths in the principal towns :—

Town.	District.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Basseterre ...	St. Kitts...	—	26	27	22	37	35	39	20	26	25	23	23	27	330
Charlestown ...	Nevis ...	—	10	5	3	7	12	1	5	2	19	5	3	6	78
Total ...	—	—	36	32	25	44	47	40	25	28	44	28	26	33	408

16. Rainfall during the year :—

Where Observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Botanic Station, Basseterre	St. Kitts	6·67	4·06	2·94	2·04	5·05	0·82	1·97	3·19	4·73	3·93	4·28	3·95	43·63
" " Charlestown	Nevis	7·18	1·96	4·14	0·81	4·47	2·23	1·77	4·92	3·50	3·89	4·41	3·36	42·64
Wall Blake	Anguilla	2·87	1·62	2·15	2·94	3·03	1·65	3·62	1·91	3·36	6·07	2·25	4·73	36·20

17. Additional information to be given if possible on the following points :—
   (*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—Yes.
   Number of notices, convictions and warnings during the year.—Several.
   (*b*) Number of children examined for enlarged spleen.—No systematic examination.
   Does kala-azar exist?—No.
   (*c*) Number of persons examined for filarial diseases.—No systematic examination.
   (*d*) Any large works for surface drainage of towns or reclamation of marshes?—Annual work.
   Approximate cost.—£100 per annum.
   (*e*) Numbers of men employed in towns or villages for petty anti-mosquito works.—10.
   Approximate cost.—£140.
   (*f*) Amount of Government quinine sold or distributed gratis during the year.—None.
   Agencies employed.—Government distributions.
   (*g*) Is quinine distributed regularly in the schools?—No.
   (*h*) Measures taken against these diseases on estates employing indentured labour.—No such estates.
   (*i*) Any steps taken regarding the housing of the poor?—
   (*j*) Any exceptional increase or decrease of these diseases recently noticed?—None.
   (*k*) Any other remarks on the subject.—Malaria not being endemic in the Presidency, no gratis distribution of quinine has been found necessary.

W. H. FRETZ,
Senior Medical Officer.

St. Kitts,
31st March, 1914.

DOMINICA.

1.	Name of Colony	Presidency of Dominica.
2.	Total area	$304\frac{2}{3}$ sq. miles.
3.	Estimated population :—	
	(*a*) Total	35,242
	(*b*) European	399
	(*c*)	
	(*d*) Other races	21,361 (black); 12, 103 (coloured)
	(*e*)	
4.	Births during the year :—	
	Total births	1,223
5.	Deaths during the year :—	
	(*a*) Total deaths	—
	(*b*) Deaths ascribed to fever	852
	(*c*) Deaths ascribed to blackwater fever	—
	(*d*) Deaths ascribed to yellow fever	—

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

6. Government hospitals :—

(a) Number of such hospitals. Two.

		Roseau Hospital. In-patients.	Roseau Hospital. Out-patients.	Roseau Hospital. Total.	Portsmouth. Total.
(b) Totals during year	admissions ...	832	796	1,628	136
	deaths	75	0	75	10
(c) Malarial fever	admissions ...	72	61	133	7
	deaths	4	0	4	0
(d) Blackwater fever	admissions ...	1	0	1	0
	deaths	0	0	0	0
(e) Yellow fever	admissions ...	0	0	0	0
	deaths	0	0	0	0
(f) Filarial diseases	admissions ...	2	0	2	4
	deaths	0	0	0	0
(g) Dengue	admissions ...	0	0	0	0
	deaths	0	0	0	0

7. Government dispensaries :—
- (a) Number of such dispensaries 17
- (b) Total attendances during year 9,826
- (c) Attendances for malaria 841
- (d) Attendances for filarial diseases ... 5
- (e) Attendances for dengue ... ... Nil

8. Medical service :—
- (a) Number of Government Medical Officers ... 4
- (b) Number of special Health Officers ... 3
- (c) Number of other registered practitioners ... 1

9. Schools :—
- (a) Number of Government and State-aided schools — 20 primary, 1 secondary, 5 aided—26
- (b) Number of scholars registered in these schools ... ... Primary 5,504, secondary 39—5,543
- (c) Percentage of daily attendances ... ... Primary 42 %, secondary 95 %

10. Estates employing indentured labour :—
- (a) Number of such ... ...
- (b) Number of indentured labourers employed ...
- (c) Number of hospitals and dispensaries on such estates ... ...
- (d) Total deaths among such labourers ... ...
- (e) Deaths ascribed to malaria ... ...
- (f) Total admissions and attendances at hospitals and dispensaries ... ...

} Nil.

11. Estimated revenue of Presidency :—
Total during year £42,067 0 0

12. Estimated expenditure of Presidency :—
- (a) Total during year 47,774 0 0
- (b) Annual medical and sanitary expenditure 2,036 0 0

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

(*c*) Upkeep of Government hospitals and dispensaries	£2,496 0 0
(*d*) Total salaries and allowances of Medical Officers	1,568 0 0
(*e*) Total annual sanitary expenditure ...	344 0 0

13. Towns under Municipalities or Town Councils :—

(*a*) Number of such	One (Roseau Town Board)
(*b*) Total population	6,700
(*c*) Total revenues	£1,402 1 4
(*d*) Total medical and sanitary expenditure	476 8 3

14. Table of deaths by Districts :—

District.	Area. Square miles.	Population.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
E	101⅚	15,957	50	50	47	35	48	47	39	42	38	32	34	27	489
F	73	9,775	14	13	20	10	11	17	16	10	8	17	10	13	159
G	129⅚	9,121	27	24	15	12	12	13	10	20	20	19	14	18	204
Total ...	—	—	91	87	82	57	71	77	65	72	66	68	58	58	582

15. Table of deaths in the principal towns :—

Town.	District where Situated.	Population of Town.	Total Deaths. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Roseau... ...	E	6,621	37	39	29	22	31	29	23	22	14	13	19	13	291
Portsmouth ...	G	1,023	6	7	5	3	3	4	0	4	5	5	4	4	50
Total		7,644	43	46	34	25	34	33	23	26	19	18	23	17	341

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16. Rainfall during the year :—

Station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Antrim Valley ...	10·71	4·00	11·39	3·36	7·48	7·15	10·88	21·00	10·36	10·93	6·69	5·53	109·48
Batalie	2·74	1·49	3·00	1·70	0·56	2·89	2·50	16·31	3·65	4·19	3·15	1·90	44·08
Bellevue	19·24	5·31	14·74	8·36	14·71	10·74	13·32	24·85	15·89	20·81	15·77	9·63	173·37
Blenheim	11·49	2·69	6·94	8·06	9·49	8·63	6·83	19·96	14·98	12·01	18·67	6·02	125·77
Botanic Gardens ...	7·48	2·32	7·29	1·57	3·46	3·49	7·57	10·93	8·39	10·40	4·28	2·72	69·90
Canefield	5·68	1·90	5·74	1·54	3·12	3·75	6·68	14·90	8·16	9·37	4·06	2·66	67·56
Castleacre	10·95	3·33	11·74	3·47	6·58	7·72	10·53	24·04	12·88	15·47	6·00	4·53	117·24
Castle Bruce ...	8·76	1·92	4·52	12·04	8·28	6·02	8·58	21·71	11·80	20·94	19·45	6·33	130·35
Concord	14·83	3·81	9·03	14·44	10·29	9·72	8·93	25·17	15·69	25·42	22·08	7·64	167·05
Corlet	23·05	4·92	16·39	10·52	11·48	12·78	15·12	29·27	19·54	28·22	21·19	10·66	203·14
Everton	11·01	1·97	9·44	2·14	7·13	6·39	11·10	19·58	21·95	14·52	8·52	5·71	119·46
Gleau Manioc ...	27·51	6·79	26·14	18·95	22·74	13·74	23·12	39·70	21·28	26·57	33·91	11·36	271·81
Goodwill	7·46	2·62	7·12	1·58	3·00	3·28	6·68	9·80	7·58	11·29	4·64	2·89	67·94
Governor	11·96	3·99	8·70	14·18	9·64	10·77	8·41	22·76	15·70	17·38	21·54	7·57	152·60
Hampstead	9·28	2·59	6·00	7·73	6·13	6·13	5·63	15·83	12·95	10·04	15·23	3·38	100·92
Hatton Garden ...	8·91	2·01	3·98	12·29	8·99	6·69	5·13	21·05	10·65	18·47	15·57	4·70	118·44
Hillsborough ...	6·61	2·50	5·16	2·35	3·09	4·65	6·05	16·03	6·22	7·09	4·96	3·61	68·32
Kinellan	16·58	5·66	15·92	8·00	7·91	9·46	12·73	23·30	18·07	9·77	16·60	7·07	151·07
La Haut	9·26	2·70	8·43	3·64	6·98	5·58	9·45	14·19	10·37	13·24	7·34	4·17	95·35
Lisdara	20·02	4·78	18·11	10·81	14·14	10·11	12·02	19·94	12·00	24·67	19·24	5·06	170·90
Londonderry ...	6·29	1·86	3·42	11·75	5·26	5·47	5·29	17·88	10·82	11·75	14·48	4·84	99·11
Melville Hall ...	8·90	2·67	5·02	11·54	6·85	6·50	5·33	21·15	11·25	14·65	16·11	4·72	114·69
Moore Park... ...	11·86	2·34	6·53	9·65	6·20	6·68	5·97	16·25	15·35	10·78	17·90	4·97	114·48
Morne Bruce ...	8·61	2·54	7·68	1·89	3·69	4·05	7·83	10·89	8·34	10·47	3·88	2·81	72·68
Picard	10·70	2·19	7·22	3·12	5·46	6·07	5·40	15·84	7·13	8·99	9·52	4·85	86·49
Pte. Mulatre ...	13·85	2·55	3·75	4·13	11·42	2·74	5·46	22·73	11·18	16·98	15·95	9·00	119·74
Rosalie	11·26	4·99	4·50	11·57	13·40	8·06	8·81	26·58	11·97	19·81	19·12	5·68	145·75
Shawford	14·76	3·06	19·78	8·19	10·92	12·29	14·59	27·80	16·20	13·69	13·38	3·83	158·49
Snug Corner ...	14·98	2·30	14·99	7·40	9·78	9·38	12·33	20·60	16·32	16·32	11·72	6·62	142·74
Soufrière	6·92	2·41	2·16	2·39	2·46	3·27	5·51	13·41	10·49	10·61	5·75	4·07	69·45
St. Aroment ...	10·01	1·78	11·16	2·57	4·67	5·13	8·29	15·35	10·16	8·71	4·79	2·61	85·23
Wall House... ...	2·95	1·45	3·50	1·77	3·02	5·27	7·28	12·93	8·70	7·80	2·55	2·25	59·47
Woodford Hill ...	8·08	1·95	4·88	12·24	7·20	5·09	4·95	16·37	10·76	14·54	14·64	3·19	103·89

Mean Rainfall,	33 Stations ...	118·09 inches.
,, ,,	12 Leeward Coast Stations	75·49 ,,
,, ,,	3 Windward ,, ,,	131·94 ,,
,, ,,	12 Inland Stations	161·03 ,,
,, ,,	6 La Soye Coast Stations	110·47 ,,

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises?—Yes. Roseau Town Board Regulations.

Numbers of notices, convictions, and warnings during the year: Convictions 3.

(*b*) Number of children examined for enlarged spleen.—1,000, District "D."

Where was this done?—At dispensaries.

Percentage affected.—60 per cent.

Does kala-azar exist?—No.

(*c*) Number of persons examined for filarial diseases.——

Where this was done?——.

Percentage affected.—Unknown.

(*d*) Any large works for surface drainage of towns or reclamation of marshes.—No.

Approximate cost.—Nil.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works.—None specially employed. Town Constables perform this duty in conjunction with ordinary sanitary duties.

(*f*) Amount of Government quinine sold or distributed gratis during the year.—9,755 grains.
Agencies employed.—Police stations.
(*g*) Is quinine distributed regularly in the schools?—No.
(*h*) Measures taken against these diseases on estates employing indentured labour.—No such estates.
(*i*) Any steps taken regarding the housing of the poor.—No.
(*j*) Any exceptional increase or decrease of these diseases recently noticed.—
(*k*) Any other remarks on the subject.——

Montserrat.

Following headings in draft return.

1. Montserrat.
2. 32½ square miles.
3. Population (1911):—

(*a*) Total	12,196
(*b*) Europeans	140
(*d*) Black and coloured ...	12,056

4. Births 364
5. Deaths 216
None caused by malaria, yellow fever, blackwater fever or dengue.
6. Government hospitals:—
(*a*) One.

(*b*) Admissions	130
Deaths	5

(*c*)-(*g*) No admissions for malaria, filariasis, blackwater fever, yellow fever or dengue.
7. Government dispensaries:—
(*a*) Four.

(*b*) Number of patients ...	2,500
Number of attendances	3,676
(*c*) Attendances for malaria	None.
(*d*) ,, ,, filariasis	8
(*e*) ,, ,, dengue	None.

8. Medical Service:—
(*a*) Two Government Medical Officers.
(*b*) One of these is Health Officer.
(*c*) No other registered practitioners.
9. Schools:—
No Government schools.

(*a*) State-aided schools ...	14
(*b*) Number of scholars ...	3,115
(*c*) Percentage of daily attendances	50 %

10. No indentured labour.

	£	s.	d.
11. Revenue of Presidency, 1912-13	£11,343	0	0
12. Expenditure of Presidency, 1912-13 ...	10,688	7	3
(*b*) Annual medical and sanitary expenditure	1,260	0	0
(*c*) Upkeep of hospitals and dispensaries ...	308	10	0
(*d*) Salaries and allowances of Medical Officers	530	0	0
(*e*) Annual sanitary expenditure	187	0	0

13. No towns under Municipal or Town Councils.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

14. Table of deaths by Districts :—

Parishes.	Population.	Total Deaths.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
St. Anthony	4,573	12	8	9	10	5	11	11	7	5	6	4	2	90
St. Patrick	819	—	1	—	2	—	2	—	1	—	1	1	1	9
St. Peter	3,545	5	6	5	1	6	3	5	4	4	4	4	5	52
St. George	3,259	3	3	5	4	11	2	10	3	6	6	5	7	65
Total	12,196	20	18	19	17	22	18	26	15	15	17	14	15	216

The town of Plymouth is situated in St. Anthony.

15. Table of deaths in principal town :—

Town.	District where Situated.	Population (1911).	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Plymouth	Parish of St. Anthony	1,534	1	2	1	2	1	3	2	3	1	1	0	0	17

16. Rainfall :—

Where Observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Botanic Station ...	St. Anthony ..	8·13	2·95	5·82	3·79	9·21	1·59	2·78	4·83	2·99	7·03	7·77	5·62	62·51

Average for the Island (21 stations) 56·18 inches.

17. (*a*) No anti-mosquito regulations in force.
(*b*) No systematic examination for enlarged spleen in children. No kala-azar.
(*c*) No systematic examination for filaria.
(*d*) No works for surface drainage, beyond the town gutters and field drains on estates, but the sloping surface gives natural drainage. One swamp on the island not drained.
(*e*) No men employed for anti-mosquito work.
(*f*) No quinine sold or distributed generally.
(*i*) In certain cases paupers are boarded out at public expense.
(*j*) No increase or decrease of above diseases.
(*k*) Of these diseases, filariasis only is known, and that occurs with moderate frequency.

J. C. McPHERSON,
Senior Medical Officer.

APPENDIX I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

No. 9.

NYASALAND.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE, FROM 1ST JANUARY, TO THE 31ST DECEMBER, 1913.

(Received in Colonial Office, 7th July, 1914.)

1. *Name of Colony*: Nyasaland.
2. *Total area*: 39,801 square miles.
3. *Estimated population*:

(*a*) Total	1,065,097
(*b*) Europeans	798
(*c*) Asiatics	387
(*d*) Africans	1,063,912

4. *Births during the year*:

(*a*) Europeans	25
(*b*) Asiatics	1
(*c*) Africans. No record.	

5. *Deaths during the year*:

(*a*) Europeans	7
(*b*) Asiatics	4
(*c*) Africans. No record.	
Deaths ascribed to fever	2
,, ,, ,, blackwater fever ...	1
,, ,, ,, yellow fever	nil

6. *Government hospitals*:

(*a*) Number of such hospitals...	8

(*b*) Totals during year: Admissions, 521; deaths, 33.
(*c*) Malarial fever: Admissions, 56; deaths, 2.
(*d*) Blackwater fever: Admissions, 7; deaths, 1.
(*e*) Yellow fever: Admissions, nil; deaths, nil.
(*f*) Filarial diseases: Admissions, nil; deaths, nil.
(*g*) Dengue:

7. *Government dispensaries*:

(*a*) Number of such dispensaries	8
(*b*) Total attendances during year	12,984
(*c*) Attendances for malaria	701
(*d*) ,, ,, filarial diseases ...	3
(*e*) ,, ,, dengue	nil

8. *Medical Service*:

(*a*) Number of Government Medical Officers	11
(*b*) ,, ,, special Health Officers ...	nil
(*c*) ,, ,, other registered practitioners	14

9. *Schools*:

(*a*) Number of schools	1,768
(*b*) Number of scholars registered in these schools	132,960
(*c*) Percentage of daily attendances. (No record; average number in attendance	87,608)

10. *Estates employing indentured labour*	nil

11. *Estimated revenue of Colony*:

Total during year	£178,272

12. *Estimated expenditure of Colony*:

(*a*) Total during year	£166,360
(*b*) Annual medical and sanitary expenditure	£9,507
(*c*) Upkeep of Government hospitals and dispensaries	£191
(*d*) Total salaries and allowances of Medical Officers	£7,391

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

(*e*) Total annual sanitary expenditure. (No record; prisoners are largely employed for clearing of bush and scrub, and for petty anti-mosquito measures).

13. *Towns under municipalities or Town Councils*:

(*a*) Number of such 4

(*b*) Total population 3,306

(*c*) Total revenues ... ...about £500

(*d*) Total medical and sanitary expenditure. No separate record.

14. *Table of deaths by districts*: No record.

15, 16. See tables attached.

17. *Additional information*:

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Yes.

Number of notices, convictions, and warnings during the year: Notices, 18; convictions, 5; warnings, 3.

(*b*) Number of children examined for enlarged spleen, 1,823.

Where was this done?—At Port Herald, Chiromo, Mlanje, Blantyre, and Karonga.

Percentage affected:

Port Herald	50·9
Chiromo	34·6
Mlanje	46·0
Blantyre	31·0
Karonga	29·6
Mean	38·42

Kala-azar has, so far, not been found to exist.

(*c*) Number of persons examined for filarial diseases—111

Where was this done?—At Chiromo.

Percentage affected.—27·9.

(*d*) Any large works for surface drainage of towns or reclamation of marshes?—No.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works.—No reliable record; at Government stations prisoners are generally employed on such work, but there are no organized mosquito brigades.

(*f*) Amount of Government quinine sold or distributed gratis during the year.—None; but natives applying for quinine at the dispensaries are supplied.

(*g*) Is quinine distributed regularly in the schools?—No.

(*h*) Measures taken against these diseases on estates employing indentured labour.—There are no indentured labourers.

(*i*) Any steps taken regarding the housing of the poor?—None necessary.

(*j*) Any exceptional increase or decrease of these diseases recently noticed?—As compared with last year there has been an increase of 199 cases of malaria, and a decrease of 4 cases of blackwater fever.

H. HEARSEY,
Principal Medical Officer,
Nyasaland.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

15.—Table of deaths in the principal towns.

Town.	District where Situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Port Herald...	Lower Shire	460	1	—	—	—	—	—	—	—	—	—	—	1	2
Mlanje ...	Mlanje ...	120	1	—	—	—	—	—	—	—	—	—	—	—	1
Blantyre ...	Blantyre ...	1,295	—	2	1	—	—	1	—	—	—	—	1	—	5
Zomba ...	Zomba ...	1,204	3	2	6	7	2	1	2	3	1	1	1	4	33
Fort Johnston	South Nyasa	227	—	—	—	1	—	—	1	—	—	—	—	—	2
Total			5	4	7	8	2	2	3	3	1	1	2	5	43

16.—Rainfall during the year.

Where Observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total Inches.
Port Herald...	Lower Shire	6·46	3·05	4·08	2·16	1·37	1·60	0·43	—	—	0·55	2·31	2·41	24·42
Chiromo ...	Ruo ...	4·99	7·18	4·97	2·87	1·04	1·07	0·15	0·09	—	—	1·55	5·15	29·06
Neno... ...	West Shire	9·57	9·07	10·86	3·04	1·58	1·24	0·07	—	—	0·78	3·79	4·09	44·09
Mlanje ...	Mlanje ...	16·15	5·56	26·27	13·74	7·28	4·88	0·80	2·38	0·16	1·23	2·83	6·58	87·86
Blantyre ...	Blantyre ...	10·74	4·24	5·67	5·12	0·65	0·67	0·11	0·05	0·16	1·23	4·73	3·94	37·31
Zomba ...	Zomba ...	8·87	6·04	13·24	4·67	2·66	0·70	—	—	0·26	1·52	9·13	4·64	51·73
Ncheu ...	Upper Shire	9·53	6·09	10·22	1·67	0·55	—	—	—	—	0·56	3·66	3·20	35·48
Fort Johnston	South Nyasa	8·19	9·57	8·60	1·50	0·11	—	–	—	—	0·21	3·82	8·19	40·19
Karonga ...	North Nyasa	5·14	5·98	9·67	4·55	2·47	0·63	—	—	—	—	0·20	10·97	39·61

No. 10.

SOUTHERN NIGERIA.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS AND DENGUE, DURING THE YEAR FROM THE 1st JANUARY TO THE 31st DECEMBER, 1913.

(Received 10th August, 1914.)

1. Name of Colony: Southern Nigeria.
2. Total area: 79,880 square miles.
3. Estimated population: 8,660,962, estimated as 5 per cent. increase on 1912
   (*a*) Total, 8,660,962.
   (*b*) Europeans, 1,589 (resident population).
   (*c*)
   (*d*) Other races, 99 Asiatics.
   (*e*)
4. Births during the year:—
   Total births, no records.
5. Deaths during the year:—No reliable records.
   (*a*) Total deaths, ——.
   (*b*) Deaths ascribed to fever, 286.
   (*c*) Deaths ascribed to blackwater fever, 6.
   (*d*) Deaths ascribed to yellow fever, 11.

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6. Government hospitals :—
   (*a*) Number of such hospitals, 51.
   (*b*) Totals, during year { admissions, 9,514. deaths, 663.
   (*c*) Malarial fever ... { admissions, 1,289. deaths, 18.
   (*d*) Blackwater fever { admissions, 28. deaths, 6.
   (*e*) Yellow fever ... { admissions, 41. deaths, 9.
   (*f*) Filarial diseases ... { admissions, 15. deaths, —.
   (*g*) Dengue ... ... { admissions, —. deaths, —.
7. Government dispensaries :—
   (*a*) Number of such dispensaries, 46.
   (*b*) Total attendances during year, 176,827.
   (*c*) Attendances for malaria, 11,217.
   (*d*) Attendances for filarial diseases, 63.
   (*e*) Attendances for dengue, —.
8. Medical service :—
   (*a*) Number of Government Medical Officers, 84.
   (*b*) Number of special Health Officers, 3.
   (*c*) Number of other registered practitioners, 11.
9. Schools :—
   (*a*) Number of Government and State-aided schools, 137.
   (*b*) Number of scholars registered in these schools, 23,022.
   (*c*) Percentage of daily attendances, 73 per cent.
10. Estates employing indentured labour :—
   (*a*) Number of such, 1.
   (*b*) Number of indentured labourers employed, 6.
   (*c*) Number of hospitals and dispensaries on such estates, —.
   (*d*) Total deaths among such labourers, —.
   (*e*) Deaths ascribed to malaria, —.
   (*f*) Total admissions and attendances at hospitals and dispensaries, —.
11. Estimated revenue of Colony :—
   Total during year, £2,719,093.
12. Estimated expenditure of Colony :—
   (*a*) Total during year, £3,018,226.
   (*b*) Annual medical and sanitary expenditure } £20,102.
   (*c*) Upkeep of Government hospitals and dispensaries } £20,102.
   (*d*) Total salaries and allowances of Medical Officers, &c., £56,519.
   (*e*) Total annual sanitary expenditure, £23,220.
13. Towns under Municipalities or Town Councils :—
   (*a*) Number of such, 1.
   (*b*) Total population, 74,893.
   (*c*) Total revenues, £24,530.
   (*d*) Total medical and sanitary expenditure, £22,635.
14. Table of deaths by districts : No reliable records.
15. Table of deaths in the principal towns :—

Town.	District where Situated.	Population of Town.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Lagos	—	63,049	161	131	156	156	163	145	195	170	143	128	154	165	1,867
Ebute Metta ...	—	12,403	27	22	30	19	30	28	32	21	20	30	27	25	311
Total		—	188	153	186	175	193	173	227	191	163	158	181	190	2,178

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

16. Rainfall in inches for 1913 :—

Stations.	Rainfall.												
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Lagos ...	Nil	2·98	1·05	2·95	7·91	16·87	15·57	2·48	5·40	4·72	0·61	0·11	60·65
Ondo ...	Nil	2·70	0·95	5·73	6·90	2·89	6·52	11·30	10·30	6·77	1·08	Nil	55·14†
Ibadan ...	Nil	0·85	*	3·78	2·31	1·77	9·60	11·35	13·63	4·20	1·70	Nil	49·19
Olokemeji	Nil	0·13	2·07	7·07	2·99	5·92	6·74	2·04	5·94	2·91	0·67	0·10	36·58
Badagri ...	Nil	4·43	1·00	2·60	5·93	11·93	18·33	1·99	5·06	7·74	0·53	Nil	59·54†
Epe ...	Nil	1·10	0·65	5·46	6·28	3·14	18·34	*	13·85	6·29	0·60	Nil	55·71
Oshogbo ...	0·05	2·65	1·13	3·38	4·16	7·80	5·13	4·02	10·36	4·05	1·80	Nil	44·53
Oyo ...	Nil	0·37	2·22	2·56	4·19	1·74	7·07	4·21	7·65	4·89	1·69	Nil	36·59
Ebute Metta	Nil	5·06	0·84	2·87	8·84	11·79	19·22	2·92	3·32	6·31	1·79	0·11	63·07
Abeokuta	Nil	0·64	2·90	4·09	5·19	6·20	9·37	4·15	6·28	5·05	0·62	Nil	44·49
Ogbomosho	Nil	0·44	0·09	3·96	7·91	3·21	5·08	5·56	12·60	4·70	0·16	Nil	43·71
Yaba ...	Nil	2·77	0·91	3·13	6·77	7·10	10·91	3·47	4·11	3·85	2·33	0·10	45·45
Forcados...	Nil	7·80	5·56	10·00	20·74	30·09	49·50	41·54	47·99	25·96	4·38	0·40	243·96
Sapele ...	Nil	5·50	0·61	7·00	8·69	14·19	16·91	30·07	13·39	9·44	Nil	0·05	105·85
Benin City	Nil	1·60	0·50	4·96	4·53	7·84	14·60	18·35	13·29	8·14	0·12	1·08	75·01
Onitsha ...	Nil	0·42	1·05	8·39	8·79	6·20	11·97	11·18	10·46	7·18	Nil	0·10	65·74
Warri ...	Nil	2·42	4·25	6·10	8·85	9·57	17·64	32·80	19·60	10·83	0·10	Nil	112·16†
Aboh ...	Nil	1·36	3·25	4·69	7·78	10·31	5·77	25·80	*	6·27	Nil	Nil	65·23†
Udi ...	0·20	0·40	3·10	5·00	10·90	13·70	*	*	*	3·99	Nil	0·03	37·32
Okwoga ...	Nil	0·96	0·90	5·51	5·34	4·28	10·64	10·37	10·76	8·36	Nil	Nil	57·12†
Asaba ...	*	0·64	0·80	5·19	7·19	6·06	*	*	9·57	5·77	Nil	Nil	35·22
Agbor ...	0·05	2·65	1·43	4·80	8·40	11·40	15·65	8·75	12·32	6·90	Nil	Nil	72·35
Bonny ...	Nil	9·58	7·69	7·86	8·34	21·44	30·72	38·10	22·70	21·90	5·02	1·70	175·05
Calabar ...	Nil	2·71	3·23	8·19	14·17	9·00	28·15	21·35	14·86	13·49	9·53	4·16	128·84
Ikot Ekpene	Nil	2·58	3·26	9·71	10·84	13·31	18·57	20·74	11·38	9·62	1·49	Nil	101·50
Ikom ...	Nil	2·89	1·39	6·54	10·09	13·60	11·88	10·68	15·16	15·70	Nil	0·11	88·04
Brass ...	1·02	5·91	4·91	7·57	9·71	25·43	30·67	26·73	30·65	13·36	5·73	0·85	162·54
Degema ...	Nil	2·97	3·19	5·07	8·50	4·72	13·23	24·98	14·98	8·41	1·40	0·46	87·91
Owerri ...	Nil	2·10	1·68	10·50	8·76	6·01	7·79	18·82	13·89	6·65	Nil	0·15	76·35
Opobo ...	Nil	4·68	4·94	11·23	2·94	8·09	26·66	32·16	14·93	8·94	Nil	0·85	115·42
Afikpo ...	Nil	0·80	0·62	4·54	10·65	11·72	8·13	9·12	3·87	6·53	Nil	0·10	56·08
Akassa ...	Nil	13·37	9·01	4·33	4·86	25·79	28·48	30·55	38·04	24·05	5·51	0·42	184·41†
Bende ...	Nil	0·95	1·24	2·81	1·92	4·08	11·24	17·30	9·64	10·72	Nil	*	59·90
Obudu ...	Nil	0·16	0·56	5·17	6·50	9·00	5·68	11·52	14·75	12·09	Nil	Nil	66·43
Okigwi ...	Nil	1·38	1·92	10·97	8·68	13·36	10·31	12·63	12·52	7·11	Nil	0·26	79·14
Abakaliki	Nil	1·27	0·24	9·51	11·65	6·92	11·37	5·72	11·37	9·46	Nil	0·26	67·77

17. Additional information to be given, if possible, on the following points :—

(*a*) Destruction of Mosquitoes Ordinance: Notices, 26,616; convictions, 2,518; warnings, numerous.

(*b*) 15,763 cases were examined at various stations throughout the whole Colony : 64·4 per cent. were normal, 20 per cent. were slightly enlarged, 15 per cent. were enlarged. No kala-azar reported.

(*c*) At Badagry 50 persons were examined, and 40 per cent. were found to be infected.

(*d*) No special large works. Routine reclamation and drainage cost approximately £4,239.

(*e*) 256 men employed at a cost of £3,906.

(*f*) 1,948,230 grains were distributed by dispensaries.

(*g*) No.

(*h*) None.

(*i*) None required.

(*k*) An epidemic of yellow fever occurred during the year; no other exceptional increase or decrease in diseases noted.

R. LAURIE.

26th April, 1914.

* No records available. † Records incomplete.

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No. 11.

STRAITS SETTLEMENTS.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS AND DENGUE DURING THE YEAR FROM 1st JANUARY TO 31st DECEMBER, 1913.

(Received 14th August, 1914.)

1. Name of Colony : Straits Settlements.	
2. Total area : 1,560 square miles.	
3. Estimated population :—	
(*a*) Total	743,010
(*b*) Europeans	7,685
(*c*) Chinese	385,822
(*d*) Other races	101,199
(*e*) Malays	248,304
	743,010
4. Births during the year :—	
Total births	19,964
5. Deaths during the year :—	
(*a*) Total deaths	25,950
(*b*) Deaths ascribed to fever :—	
(1) Unspecified fever	4,746
(2) Malaria	2,878
(3) Typhoid	104
(4) Dengue	nil
(*c*) Deaths ascribed to blackwater fever ...	2
(*d*) Deaths ascribed to yellow fever... ...	nil
(*e*) Deaths ascribed to kala-azar	1
6. Government hospitals :—	
(*a*) Number of such hospitals	30
(*b*) Totals during the year :—	
Admissions	36,840
Deaths	3,935
(*c*) Malarial fever :—	
Admissions	7,864
Deaths	479
(*d*) Blackwater fever :—	
Admissions	2
Deaths	—
(*e*) Yellow fever :—	
Admissions	—
Deaths	—
(*f*) Filarial diseases :—	
Admissions	17
Deaths	—
(*g*) Dengue :—	
Admissions	—
Deaths	—
7. Government dispensaries :	
(*a*) Number of such dispensaries	15
(*b*) Total attendances during 1913	40,773
(*c*) Attendances for malaria...	3,963
(*d*) Attendances for filarial diseases ...	—
(*e*) Attendances for dengue	77
8. Medical service :—	
(*a*) Number of Government Medical Officers	28
Number of Assistant Surgeons... ...	30

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(*b*) Number of special Health Officers :—

Singapore	Government	3
	Municipal	5
Penang	Government	1
	Municipal	2
	Total	11

The Health Officer in Malacca and Labuan is the Government Medical Officer in each of those places. Provision has been made in the estimates for three Health Officers for the three Settlements, but they have not yet arrived.

(*c*) Number of other registered medical practitioners 119

9. Schools :—

(*a*) Number of Government and State-aided schools :—

Total 226

(*b*) Number of scholars registered ... ...

(*c*) Percentage of daily attendances ...

As to (*b*) and (*c*) please see accompanying statement.

10. Estates employing indentured or free labour :—

(*a*) Number of such :—

Singapore	147 estates
Penang	39 estates
Dindings	
Province Wellesley	
Malacca	35 estates
Total	221

(*b*) Number of coolies employed :—

Singapore	5,663
Penang	14,689
Province Wellesley	
Dindings	
Malacca	17,908
Total	38,260

(*c*) Number of hospitals and dispensaries on such estates :—

Singapore	5
Penang	30
Province Wellesley	
Dindings	
Malacca	38
Total	73

(*d*) Total deaths among such labourers :—

Singapore	5
Penang	295
Province Wellesley	
Dindings	
Malacca	351
Total	651

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(*e*) Deaths ascribed to malaria :—

Singapore	1
Penang	} 12
Province Wellesley	
Dindings	
Malacca	113
Total	126

(*f*) Total admissions and attendances at hospitals and dispensaries :—

Singapore	694
Penang	} 20,475
Province Wellesley	
Dindings	
Malacca	38,812
Total	59,981

11. Estimated revenue of the Colony :—

The following figures are exclusive of municipalities, for which please see item 13 (*c*) below :—

Colonial revenue	$10,890,368
Hospital Board revenue	149,270
Rural Board revenue	505,453
Education Board revenue	202,170
Total	$11,747,261

12. Estimated expenditure :—

Colonial expenditure	$11,018,114
Hospital Board expenditure	326,157
Rural Board expenditure	810,169
Education Board expenditure	222,670
(*a*) Total, 1913	$12,377,110

(*b*) Annual medical and sanitary expenditure inclusive of salaries :—

Singapore	$1,683,060
Penang	132,562
Malacca	44,132
Labuan	6,730
Total	$1,866,484

(*c*) Upkeep of Government hospitals and dispensaries :—

Singapore	$534,392
Penang	157,575
Malacca	13,615
Labuan	1,956
Total	$707,538

(*d*) Total salaries and allowances of :—

Medical Officers	$142,830
Assistant Surgeons	50,009
	$192,839

(*e*) Total annual sanitary expenditure :—

Singapore	$392,063
Penang	55,843
Malacca	8,167
Labuan	2,847
	$458,920

(The above figures for (*a*), (*b*), (*c*), (*d*), and (*e*) are exclusive of Municipalities.)

13. Towns under Municipalities or Town Councils.

(*a*) Number of such 3

(*b*) Population :—

Singapore	275,043
Penang	102,913
Malacca	21,300
Total	399,256

(*c*) Total revenue estimated :—

Singapore	$3,528,850
Penang	937,417
Malacca	134,207
Total	$4,600,474

(*d*) Total medical and sanitary expenditure under the following headings :—Health Department, Cemeteries, Conservancy, Sewerage and Disposal, Malaria Prevention, Drainage, Pathological Department, Improvement of Insanitary Areas, Isolation Hospital, Back Lanes, Markets, Slaughter Houses, and Water Supply, was :—

For Singapore	$2,096,565
For Penang	59,817
For Malacca	25,477
Total	$2,181,859

14. Table of deaths by district :—

District.	Area. Square miles.	Population.	Total Deaths.												
			January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Singapore ...	217	See Section 3 above.	885	689	816	878	978	1,054	1,035	920	988	1,143	984	957	11,327
Penang ...	108		401	341	384	431	507	476	488	458	360	400	408	415	5,069
Province Wellesley	280		297	268	266	299	294	367	368	385	324	302	303	307	3,775
Dindings ...	183		32	29	24	21	22	20	28	29	29	30	21	17	302
Malacca ...	720		447	436	411	449	547	461	415	388	412	422	445	500	5,333
Labuan ...	28		5	9	10	5	16	19	13	13	10	9	20	15	144
Total			2,067	1,767	1,911	2,083	2,364	2,397	2,347	2,193	2,123	2,306	2,181	2,211	25,950

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15. Table of deaths in the principal towns :—

Town.	Population.	Total Deaths.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Singapore ...	275,043	766	594	670	723	842	878	877	758	762	874	829	814	9,387
Penang ...	102,913	301	249	266	302	344	324	334	319	269	280	300	307	3,595
Malacca ...	21,300	48	70	76	69	77	69	70	69	69	75	72	67	831
Total		1,115	913	1,012	1,094	1,263	1,271	1,281	1,146	1,100	1,229	1,201	1,188	13,813

16. Rainfall during the year (mean) :—

Where Observed.	Rainfall.												
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Singapore.	17·67	7·46	17·12	10·06	7·26	13·96	6·31	3·14	10·62	10·72	14·60	12·18	131·10
Penang ...	4·38	1·61	4·24	6·27	17·41	11·52	5·35	5·74	21·71	19·20	15·98	6·61	120·02
Dindings..	9·32	5·16	5·13	5·55	9·28	7·20	2·61	0·54	5·68	7·78	8·43	6·53	73·21
Province Wellesley	5·59	1·68	5·82	9·22	13·56	9·75	4·17	4·68	15·90	14·86	14·51	6·18	105·92
Malacca...	5·57	2·09	3·55	5·82	7·08	7·26	4·17	6·35	8·87	10·05	10·37	4·13	75·31
Labuan ...	4·13	1·64	2·51	4·99	18·23	20·46	9·22	5·63	22·99	21·27	16·38	13·85	141·30

17. (*b*) Number of children examined for enlarged spleen, etc. :—

Singapore : 208 children were examined, of whom 30 were found to have enlarged spleen, or 14·42 per cent.

Penang : 4,362 children examined in vernacular schools, etc. Percentage affected, 7·91.

Malacca : 1,593 = 63·6 per cent. infected. They were examined in all schools and police stations.

Labuan : 105 = 19·04 per cent. infected. Examined in schools.

(*d*) Any large works for surface drainage, etc :—

Singapore : Reclamation of swamps by filling and by drainage, $10,000; subsoil drainage of malarial swamps, $10,000; anti-malarial works, $5,000.

Penang : Miscellaneous works carried out under this head during the year cost $83,497.

Malacca : A sum of $2,903 was spent in surface drainage, etc.

(*e*) Number of men employed on special anti-mosquito works.

Singapore : 45 men. Cost, $6,946.

Penang : An average of 91 coolies per month were employed within municipal limits. Cost, $13,500.

Malacca : Nil.

Labuan : None except one sanitary inspector.

(*f*) Amount of Government quinine sold or distributed gratis :—

Singapore : 72,000 grains were distributed by the Municipality, gratis.

Penang : 18¾ lbs. distributed at out-door dispensaries and estates (gratis).

Malacca : 20 lbs. 2 ozs.

Labuan : 132 ozs., gratis.

(*g*) Is quinine distributed regularly in the schools?
Singapore: Yes.
Penang: Yes.
Malacca: Yes.
Labuan: No.

(*h*) Measures taken against these diseases on estates:—
The group hospital scheme referred to in my previous report is being enforced and regulations thereunder have been passed. The estate managers are being kept to the requirements of Estate Ordinances in force, referred to in my previous reports. Sanitary lines, wells, and latrines are insisted upon.

(*i*) Any steps regarding the housing of the poor:—
Singapore and Penang: Considerable progress has been made in these municipalities and in many villages by the destruction of insanitary houses and by the provision of back lanes.

(*j*) and (*k*) Any exceptional increase or decrease of these diseases recently noticed:
The year under report was marked by a great decrease in the prevalence of malaria, as compared with 1911, all through the peninsula, and it is impossible to say what effect the measures taken will have on the prevalence of the disease in the next malarial year. Dr. Finlayson finds that the spleen rate among the children at the schools in the Teluk Blanga District progressively decreased until it ultimately reached zero, and it is hoped that this may be an indication that the breeding places of fever-bearing anophelines provided by the streams in the ravines have been successfully dealt with, and that in a district which was the most malarious in town. Malarial fever has, at least for the time, been considerably reduced.

W. GILMORE ELLIS,
Principal Civil Medical Officer,
Straits Settlements.

25th June, 1914.

Enclosure 1, *vide* Question 9.

—	Number of Schools.	Average Enrolment.	Average Attendances.
SINGAPORE.			
English Schools—			
Government schools, boys' and girls'	5	2,270	2,136
Aided " " "	11	5,259	4,947
Vernacular Schools—			
Government schools, boys' and girls'	18	1,263	1,137
Aided " " "	—	—	—
MALACCA.			
English Schools—			
Government schools, boys' and girls'	2	489	461
Aided " " "	6	1,035	965
Vernacular Schools—			
Government schools, boys' and girls'	76	4,800	4,352
Aided " " "	—	—	—
PENANG.			
English Schools—			
Government schools, boys' and girls'	1	253	224
Aided " " "	14	4,990	4,592
Vernacular Schools—			
Government schools, boys' and girls'	90	6,364	5,403
Aided " " "	3	134	111

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REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

No. 12.

ZANZIBAR.

The CHIEF SECRETARY to the TROPICAL DISEASES RESEARCH FUND.

(Received 20th August, 1914.)

Sir, The Secretariat, Zanzibar, 10th July, 1914.

I am directed to transmit, for your information, a report by Major Skelton, R.A.M.C., Medical Officer of Health, on the prevention of mosquito-borne diseases during the year 1913.

I have, &c.,
R. H. CROFTON,
Chief Secretary.

Enclosure in No. 12.

Health Office, Zanzibar, 30th June, 1914.

Sir,

I have the honour to forward to you a report for the year 1913 on the prevention of mosquito-borne diseases.

I should be glad if you would forward this report to the Advisory Committee for the Tropical Diseases Research Fund.

From the figures submitted it will be seen that mosquito-borne diseases have been responsible for :—

	Percentage		
During	1913	1912	1911.
Of the total deaths	24·7	16·7	—
Of the total admissions to hospitals ...	25·6	21·5	25·0
Of the total attendances	6·2	6·5	9·0

The rise in the death-rate percentage from mosquito-borne diseases is due, I think, to the fact that better notification is being obtained in the outlying districts and in Pemba.

The number of deaths from malaria alone in the City of Zanzibar shows a satisfactory fall during 1913 as compared with previous years.

This can be seen from the following table :—

	In Zanzibar City.			
During	1913	1912	1911	1910
Deaths from malaria...	159	171	189	203

This is due to three factors :

(i) The gradual annihilation of anopheline breeding places within the environs of the town. During the past year, as will be seen from a later paragraph in this report, a sum of Rs.19,068 was spent in drainage work on two areas that formerly were constant anopheline distributing centres. A further sum of Rs.10,000 is authorized to be spent on further drainage during the current year.

It is, however, not only in the outskirts of the town that anophelines are discovered breeding, they are unfortunately also found right in the town itself and not infrequently in the European quarter. In fact, anophelines were discovered by the mosquito-brigade on 45 occasions during the period under review, and of these 37 were certainly preventable, and should have been prevented, as they were found in collections of water in private gardens and such like.

(ii) In my report to the Committee for last year reference was made to the proposed formation of a mosquito brigade. This came into being in March, 1913, after the Inspectors had undergone a course of instruction in the habits and life history of the mosquito, its common breeding places, &c., and were able to distinguish the more common larval forms.

The brigade consists of five Inspectors, each of whom has three men under him. The town is divided into five districts, and it is the duty of the District Inspector to pay a weekly visit to each house in his district as near as possible on the same day of the week and at the same hour of the day.

The house and garden is inspected and, if necessary, kerosene oil is poured into the cess-pits.

During 1913 the brigade discovered mosquitoes breeding on 1,001 occasions, of which 74 were in European houses. The following short table shows the fall in the index per 100 houses examined :—

During	Visits of Insections.	Larvæ Found.	Index per 100 Houses.	Rainfall.
March	2,604	136	5·1	9·99
April	3,600	140	3·0	17·59
May	4,665	143	3·08	11·18
June	3,594	34	0·9	0·07
July	4,546	39	0·85	0·31
August	5,492	36	0·67	0·88
September*	6,162	127	2·06	2·58
October	7,823	121	1·54	4·22
November	7,415	113	1·52	3·20
December	7,178	113	1·57	1·30
Total	53,079	1,001	1·88 average.	—

By putting the rainfall alongside the index it will be seen that the fall in the index was not due to dry weather altogether.

I consider that the work of the brigade is a factor contributing to a lowered death-rate from malâria in the town.

(iii) The use of the mosquito nets is, I feel sure, becoming more common amongst not only the better educated Indian communities but also amongst even the better paid Swahili. Servants, no doubt, learn the habit from their masters. Once the use of a net becomes a fashion it is bound to spread rapidly among the Zanzibari.

Very real efforts are being made in malarial education. Weekly lectures on hygiene are given to school teachers, not only to those employed by Government but also to those in the Indian schools.

School children are taken out from time to time for "field work" and are taught to hunt out breeding places for mosquitoes, &c. Small prizes are given for the best collectors. The reasons for this insect-hunting are carefully explained to the children.

In regard to the prevalence of filarial disease in the Islands—elephantiasis, lymph scrotum and filarial abscesses are very common.

Dr. Howard, of the Universities Mission, contributes a note to the Public Health Department's Annual Report for 1913, in which he states that, in series of 227 consecutive cases admitted to his hospital for various complaints, in 49 instances microfilaria nocturna were found. Dr. Howard considers that at least one in five of the native inhabitants of Zanzibar harbour micro-filaria, but that fortunately only a proportion of this number show any symptoms. At the same time, he considers that of the mosquito-borne diseases present filariasis is responsible for the greatest amount of ill-health and sufferings.

I thoroughly agree with Dr. Howard's views, and I think the reason why a larger figure is not found in the column for hospital attendance for filaria is because the disease in its many manifestations is so common that the sufferer will not bother himself to come to hospital for treatment. It can only be hoped that as the result of the work of the mosquito-brigade the index for culex fatigans falls so will the incidence of filarial disease.

I have, &c.,

D. S. SKELTON, Major, R.A.M.C.,

Medical Officer of Health.

The Chief Secretary.

* Inspection extended to the Swahili quarter.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

Report on Mosquito-borne Diseases.

(January 1st—December 31st, 1913.)

1. Name of Protectorate: Zanzibar (including Pemba).
2. Total area of both islands: 1,020 square miles.
3. Estimated population: (Census 1910).
   - (*a*) Total 197,199
   - (*b*) Europeans 234
   - (*c*) Indian and Cingalese 8,305
   - (*d*) Other races 188,660
4. Births during the year:—
   - (*a*) Total births 2,832
5. Deaths during the year:—

Deaths.	Europeans.	Other Races.	Total.
(a) Total deaths	5	4,358	4,332
(b) Deaths ascribed to fever	1	1,077	1,078
(c) Deaths ascribed to blackwater ...	—	—	—
(d) Deaths ascribed to yellow fever ...	—	—	—

6. Hospitals:—

(*a*) Number of hospitals { Government ... 7; „ Europeans 1; Private (U.M.C.A.) ... 1

Total ... 9

	Government Hospital.		U.M.C.A.		Total.		Grand Total.
	Europeans.	Other Races.	Europeans.	Other Races.	Europeans.	Other Races.	
Total during the year—							
Admissions	21	2,521	30	304	51	2,825	2,876
Deaths	—	75	—	20	—	95	95
Malarial fever—							
Admissions	12	617	30	100	42	717	759
Deaths	—	5	—	—	—	5	5
Blackwater fever—							
Admissions	—	2	—	1	—	3	3
Deaths	—	—	—	—	—	—	—
Yellow fever							
Admissions	—	—	—	—	—	—	—
Deaths	—	—	—	—	—	—	—
Filarial diseases—							
Admissions	—	70	—	—	—	70	70
Deaths	—	4	—	—	—	4	4
Dengue—							
Admissions	—	—	—	—	—	—	—
Deaths	—	—	—	—	—	—	—

7. Dispensaries:—

(*a*) Number of dispensaries { Government ... 8; Private Khoja 1; U.M.C.A. ... 1 — 2

Total ... 10

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

	Government.		Private.		Total.		Grand Total.
	Europeans.	Other Races.	Europeans.	Other Races.	Europeans.	Other Races.	
Total attendance during year...	169	41,055	12	13,827	181	54,882	55,063
Attendance for malaria ...	11	2,131	6	856	17	2,987	3,004
Attendance for filarial diseases	—	159	—	263	—	422	422
Attendance for dengue ...	—	—	—	—	—	—	—
Attendance for blackwater fever	—	—	—	—	—	—	—

8. Medical Service :—
   (a) Number of Government Medical Officers ... 7
   (b) Number of Special Health Officers 2
   (c) Number of other registered practitioners ... 2
9. Schools :—
   (a) Number of Government and State-aided schools 6
   (b) Number of scholars registered in the schools 632
   (c) Percentage of daily attendance ... ... 86·27
10. There are no estates employing indentured labour.
11. Estimated revenue of the Protectorate :—
   (a) Total revenue during the year ... £210,452
12. Estimated expenditure of the Protectorate :—
   (a) Total during the year £226,611
   (b) Annual medical and sanitary expenditure £23,380
   (c) Upkeep of Government hospitals and dispensaries £6,146
   (d) Total salaries and allowances of Medical Officers £3,470
   (e) Total annual sanitary expenditure* ... £13,511
13. No towns under municipalities.
14. Table of deaths by districts :—

Districts.	No. of deaths.	Total.
Island of Zanzibar :—		
Zanzibar Town	1,128†	
Mkokotoni	889	
Chwaka	328	
Mwera	766	
		3,111
Island of Pemba :—		
Chake Chake	567	
Weti	435	
M'Koani	219	
		1,221
Total for both islands ...		4,332

15. Table of deaths in principal towns (see No. 14).
16. Rainfall during the year :—

January	0·39
February	1·37
March	9·99
April	17·59
May	11·18
June	0·07
July	0·31
Carried forward ...	40·90

* Including the upkeep of leper and poor establishments and of the quarantine station.

† Includes 85 deaths in the Poor House and 21 in the Leper Asylum at Walezo.

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

Brought forward ...	40·90
August	0·88
September	2·58
October	4·22
November	3·20
December	1·31
Total ...	53·09
Average ...	77·03

17. Additional information to be given, if possible, on the following points:—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Yes. Under the Public Health Decree. "Any collection of water in any well, pool, channel, barrel, tub, bucket, or any other vessel, and found by the Health Officer to contain mosquito larvæ, shall be liable to be dealt with under this decree."

Number of notices during the year ...	881
Number of convictions	32
Number of warnings	581

(*b*) Number of persons of the age of 15 examined for enlarged spleen ... 298

Where was this done? At the Government School.

Percentage affected ... ... 23·4

(*c*) Does Kala-azar exist? No.

(*d*) Number of persons examined for filarial diseases 227

Where was this done? Mkunazini Mission Hospital. Percentage affected ... 21·59

(*e*) Large works for surface drainage of towns and reclamations of swamps:—

(i) Kiungani Swamp drain ... ...Rs. 15,000

(ii) Zinani Swamp outlet to the sea ...Rs. 4,068

(*f*) Number of men employed in town for petty anti-mosquito work—

In Zanzibar Town. (See introductory remarks.)

In Pemba the Sanitary Inspector at Chake Chake and two Sub-Inspectors at Weti and M'Koani go round once in a week.

(*g*) Amount of quinine sold or distributed gratis during the year.

Sold in packets of 5 grains each	17 ozs. 5 drs.
Distributed gratis	50 ozs. 4 drs.

(*h*) Is quinine regularly distributed in the schools? Yes.

(*i*) Not applicable. There is no indentured labour.

(*j*) Housing of poor:—Wherever possible insanitary native huts in Zanzibar are being demolished. There is a poor house at Walezo.

(*k*) Increase or decrease in the diseases noted:—(*Vide* introductory remarks).

(*l*) Any other remarks on the subject:—(*Vide* introductory remarks).

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

No. 13.

MAURITIUS.

The ACTING GOVERNOR to the SECRETARY OF STATE.

(Received 16th September, 1914.)

Sir, Government House, Port Louis, 27th July, 1914.

In compliance with the instructions contained in your Circular despatch of the 20th December, 1910,* I have the honour to transmit herewith two copies of the return of malarial fever and other tropical diseases during the year ended 31st December, 1913.

2. In paragraph 17 (*a*) of the return for 1912,† it was stated that legislation to prohibit the breeding of mosquitoes in premises was in course of preparation, and the matter is specifically dealt with in Article 4 of Ordinance No. 31, of 1913.

I have, &c.,

J. MIDDLETON.

Enclosure in No. 13.

Return of Anti-Malarial Measures and of Mosquito-Borne Diseases, 1913.

1. Name of Colony : Mauritius.	
2. Total area : 720 square miles.	
3. Estimated population on 31st December, 1913 :—	
(*a*) Total population	373,185
(*b*) General ,, ...	108,814
(*c*) Indian ,, ...	258,837
(*d*) Chinese ,, ...	5,534
4. Births during the year	15,153
5. Deaths during the year	13,201
(*a*) Ascribed to fever (malaria included) ...	4,001
(*b*) ,, ,, blackwater fever	nil
(*c*) ,, ,, yellow fever	nil
6. Government hospitals :—	
(*a*) Number	12
(*b*) Admissions during the year	16,685
(*c*) Malarial fever :	
Admissions	2,546
Deaths	47
(*d*) Blackwater fever	nil
(*e*) Yellow fever	nil
(*f*) Filarial diseases :	
Admissions	27
Deaths	nil
(*g*) Dengue	nil
7. Government dispensaries :—	
(*a*) Number	28
(*b*) Total attendances	48,356
(*c*) Attendances for malaria	14,688
(*d*) ,, ,, filarial diseases ...	32
(*e*) ,, ,, dengue	nil
8. Medical service :—	
(*a*) Number of Government Medical Officers	23
(*b*) Number of special Health Officers ...	5
(*c*) Number of other registered practitioners	39

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* Appendix I., page 4. † See page 12 of [Cd. 7261], March, 1914.

APPENDIX I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &C.

9. Schools:—
 (*a*) Number of Government and State-aided schools 149
 (*b*) Number of scholars registered in these schools 20,325
 (*c*) Percentage of daily attendances:—
  (i) Government schools ... ... 61·72
  (ii) Aided schools ... ... 65·76
10. Estates employing indentured labour:—
 (*a*) Number 112
 (*b*) Number of indentured labourers employed 33,270
 (*c*) Number of hospitals and dispensaries... 108
 (*d*) Total deaths among such labourers ... 2,343
 (*e*) Deaths ascribed to malaria 217
 (*f*) Total admissions and attendances at hospitals and dispensaries: the manner in which the estate hospital records are kept does not allow of this information being obtained, and the law, as it stands, does not compel the Medical Officer to supply it.
11. Estimated revenue of the Colony during the year 1913-14, Rs.10,939,500.
12. Estimated expenditure of the Colony during the year 1913-14:
 (*a*) Total during the year, Rs.10,589,500.
 (*b*) Annual medical and sanitary expenditure, Rs. 1,089,100.
 (*c*) Upkeep of Government hospitals and dispensaries, Rs.287,030. (exclusive of repairs, additions, &c., to buildings, Rs.41,200).
 (*d*) Total salaries and allowances of Medical Officers, Rs.116,630.
 (*e*) Total annual sanitary expenditure, Rs.363,603.
13. Towns under Municipalities and Town Councils:—
 (*a*) Number: 4 (Port Louis, Curepipe, Quatre Bornes, and Beau Bassin-Rose Hill).
 (*b*) Total population: 80,909 (Census of 31st March, 1911).
 (*c*) Total revenues: Rs.658,997.
 (*d*) Total medical and sanitary expenditure: Rs. 114,565.
14. Table of deaths in the Colony by districts: *Vide* Annexure A.
15. Deaths in the principal towns during the year:—

Port Louis	1,810
Curepipe	342
Quatre Bornes	175
Beau Bassin-Rose Hill	386

16. Rainfall during the year: *Vide* Annexure B.
17. Additional information:—
 (*a*) Is there any legislation in force against the breeding of mosquitoes in premises?
  Under the Public Health Ordinance, No. 32 of 1894-95, Article 29 (*f*), any accumulation of water injurious to health is punishable as a nuisance. Further legislation has been introduced to prohibit the breeding of mosquitoes and the matter is specifically dealt with in Article 4 of Ordinance No. 31 of 1913, which came into force on 13th December, 1913.
 (*b*) Number of children examined for enlarged spleen: 13,605.
  Where was this done?—In the primary schools.
  Percentage affected: 19·82.
  Does kala-azar exist?—No.
 (*c*) Number of persons examined for filarial diseases?—None.
 (*d*) Anti-malarial works of a permanent character are being undertaken over the whole of the island costing Rs.1,000,000 approximately. A sum of Rs.150,000 is annually provided for this purpose.
 (*e*) 186 men are employed in towns and villages for petty anti-mosquito works at a cost of Rs.3,050 per month. A sum of Rs.50,000 is spent annually on minor anti-malarial works and quinine distribution (Rs.10,000).

(*f*) 488 lbs. 2 ozs. of quinine have been distributed gratis during the year by specially appointed distributors. The drug is also distributed regularly, as far as possible, in the schools. The sale of quinine at cost price is now effected at all the Government dispensaries.

(*g*) Quinine is distributed regularly in the schools. See (*f*).

(*h*) Measures taken against these diseases on estates employing indentured labour?

An Ordinance, No. 15 of 1913, was passed last year providing for major anti-malarial works at the joint expense of Government and of the private parties benefited.

(*i*) Any steps regarding the housing of the poor?—None.

(*j*) Any exceptional increase or decrease of these diseases recently noticed?—Although the figures for malaria show a decrease it is still too early to judge of the results obtained from the campaign against malaria.

(*k*) A general anti-malarial campaign has been started and works of a permanent character carried out, particularly in the districts of Pamplemousses, Flacq and Black River. Rivers are being canalized and cleaned, marshes reclaimed, and objectionable collections of stagnant water removed. Works of a minor character continue to be carried on, such as filling in of hollows and water holes, cleaning of canals, trenches, upkeep of permanent works, &c. Quinine is distributed free by special distributors, and the drug is sold at the Government dispensaries at cost price. It is still too early to see what effect these measures have on the public health as regards malaria, and it is only when the campaign will have been well on its way that any improvement is expected to be felt.

ANNEXURE A.

NUMBER OF DEATHS IN THE ISLAND OF MAURITIUS DURING THE YEAR 1913, AND DURING EACH MONTH OF THE YEAR.

Districts.	January	February	March	April	May	June	July	August	September	October	November	December	Total
Port Louis	197	160	233	209	232	220	176	170	73	214	173	157	2,314
Pamplemousses	198	168	178	135	103	110	125	134	91	98	82	74	1,496
Riviere du Rempart	155	160	128	84	64	87	98	72	66	61	54	67	1,096
Flacq	311	235	209	158	192	171	164	128	142	122	114	105	2,051
Grand Port	209	227	167	147	128	138	161	148	107	107	96	105	1,740
Savanne	97	93	90	85	79	94	112	85	82	82	70	83	1,052
Plaines Wilhems	262	198	190	137	151	148	161	148	133	126	126	115	1,895
Moka	151	99	104	73	81	68	75	69	63	69	76	64	992
Black River	86	42	53	76	42	51	43	43	35	29	23	42	565

Grand Total ... 13,201

ANNEXURE B.

RAINFALL IN MAURITIUS DURING THE YEAR 1913.
In inches.

Where observed	District.	January	February	March	April	May	June	July	August	September	October	November	December	Grand Total
Observatory	Pamplemousses	15·83	5·69	2·89	4·66	2·27	10·84	0·85	2·17	1·42	1·03	0·83	5·37	53·85
The Manse	Plaines Wilhems	8·68	6·53	3·56	3·64	1·06	6·69	0·64	2·18	0·30	1·35	0·78	3·53	38·89
Curepipe ...	do.	12·59	11·39	14·80	7·17	4·16	10·52	5·20	7·75	2·68	2·17	2·13	4·72	85·28
Alma ...	Moka	25·51	19·31	14·53	12·00	8·72	15·67	4·27	10·50	4·26	1·16	2·10	10·89	128·92

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

No. 14.

NORTHERN TERRITORY OF AUSTRALIA.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1st JANUARY TO THE 31st DECEMBER, 1912.

(Received in Colonial Office, 2nd October, 1914.)

1. Name of Colony: Northern Territory of Australia.
2. Total area: 523,620 square miles.
3. Estimated population:—
   (*a*) Total 3,459, and about 20,000 aboriginals.
   (*b*) Europeans, 1,931.
   (*c*) Chinese 1,246.
   (*d*) Other races, 282.
   (*e*) Aboriginals about 20,000.
4. Births during the year:—
   Total births, 37; Europeans 17, other 20, = 37.*
5. Deaths during the year:—
   (*a*) Total deaths, 64; (European 29, Chinese 27, other races 8).
   (*b*) Deaths ascribed to fever: Nil.
   (*c*) Deaths ascribed to blackwater fever: Nil.
   (*d*) Deaths ascribed to yellow fever: Nil.
6. Government hospitals:—
   (*a*) Number of such hospitals, 2.
   (*b*) Totals during year: Admissions 228, deaths 19.
   (*c*) Malarial fever: Admissions 12, deaths nil.
   (*d*) Blackwater fever: Nil.
   (*e*) Yellow fever: Nil.
   (*f*) Filarial diseases: Nil.
   (*g*) Dengue: Nil.
7. Government dispensaries: Nil.
8. Medical Service:—
   (*a*) Number of Government Medical Officers: 2.
   (*b*) Number of special Health Officers: 1. (Included in (*a*); appointed Medical Officer of Health for Territory, May, 1912).
   (*c*) Number of other registered practitioners: Nil.
9. Schools:—
   (*a*) Number of Government and State-aided schools: 3.
   (*b*) Number of scholars registered in these schools: 133.
   (*c*) Percentage of daily attendances: 72·5.
10. Estates employing indentured labour: Nil.
11. Actual revenue of Colony:—
    Total during year 1911-12: £47,152.
12. Actual expenditure of Colony:—
    (*a*) Total during year 1911-12: £122,685. In addition, Commonwealth paid interest on loans and sinking fund, £168,531.
    (*b*) Annual medical and sanitary expenditure, £3,021.
    (*c*) Upkeep of Government hospitals and dispensaries, £1,039. (Excluding nursing staff).
    (*d*) Total salaries and allowances of Medical Officers, £1,450.
    (*e*) Total annual sanitary expenditure, £100.
13. Towns under Municipalities or Town Councils:—
    (*a*) Number of such: 1.
    (*b*) Total population: 1,100.
    (*c*) Total revenues: About £1,000.
    (*d*) Total medical and sanitary expenditure: About £200.

---

* *Birthrate.*—Low birthrate is due to very small population of females of childbearing age. Population of Territory is mainly male.

14. Table of deaths by districts : No deaths from malaria.

15. Table of deaths in the principal towns :—Town : Darwin. District where situated : Coast. Population of town : 1,100. No deaths from malaria.

16. Rainfall during the year :—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November	December.	Total.
Darwin	Coast ...	1399	1439	1449	417	7	7	5	1	98	101	612	968	6503 points.

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Numbers of notices, convictions, and warnings during the year.—Legislation in preparation.

(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does kala-azar exist?—Not been observed.

(*c*) Number of persons examined for filarial diseases. Where this was done. Percentage affected.—No systematic examination. No cases observed.

(*d*) Any large works for surface drainage of towns or reclamation of marshes : Nil.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works : Nil.

(*f*) Amount of Government quinine sold or distributed gratis during the year : Nil.

(*g*) Is quinine distributed regularly in the schools?—No.

(*h*) Measures taken against these diseases on estates employing indentured labour.—No indentured labour employed except in Pearling trade.

(*i*) Any steps taken regarding the housing of the poor : No.

(*j*) Any exceptional increase or decrease of these diseases recently noticed.——

(*k*) Any other remarks on the subject : No.

NORTHERN TERRITORY OF AUSTRALIA.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM THE 1ST JANUARY TO THE 31ST DECEMBER, 1913.

(Received in Colonial Office, 2nd October, 1914.)

1. Name of Colony : Northern Territory of Australia.
2. Total area : 523,620 square miles.
3. Estimated population :—

(*a*) Total : 3,588 whites and Asiatics (and about 20,000 aboriginals).

(*b*) Europeans, 2,143.

(*c*) Chinese, 1,173.

(*d*) Other races 272.

(*e*) Aboriginals about 20,000.

4. Births during the year :—

Total births, excluding aboriginals, 59 : Europeans 22, other races, 37, = 59.*

* *Birthrate.*—Low birthrate is due to very small population of females of childbearing age. Population of Territory is mainly male.

5. Deaths during the year:—
   (a) Total deaths: 57; European 22, other races 35, = 57.
   (b) Deaths ascribed to fever: 1.
   (c) Deaths ascribed to blackwater fever: Nil.
   (d) Deaths ascribed to yellow fever: Nil.
6. Government hospitals:—
   (a) Number of such hospitals, 2.
   (b) Totals during year: Admissions 273, deaths 14.
   (c) Malarial fever: Admissions 6, deaths nil.
   (d) Blackwater fever: Nil.
   (e) Yellow fever: Nil.
   (f) Filarial diseases: Nil.
   (g) Dengue: Nil.
7. Government dispensaries: Nil.
8. Medical Service:—
   (a) Number of Government Medical Officers: 3. (Each a gazetted Medical Officer of Health).
   (b) Number of special Health Officers: 1. (Included in (a) as Chief Health Officer). (Also 1 fully qualified Sanitary Inspector).
   (c) Number of other registered practitioners: Nil.
9. Schools:—
   (a) Number of Government and State-aided schools: 3.
   (b) Number of scholars registered in these schools: 117.
   (c) Percentage of daily attendances: 72·7.

10. Estates employing indentured labour:—The only indentured labour is that of about 100 Malays and Philipinos employed in pearling industry. No fever occurs amongst them.

11. Actual revenue of Colony:—
   Total during year 1912-13: £56,317.

12. Actual expenditure of Colony:—
   (a) Total during year 1912-13: £233,636. In addition, Commonwealth paid interest on loans and sinking fund, £149,062.
   (b) Annual medical and sanitary expenditure: £5,592.
   (c) Upkeep of Government hospitals and dispensaries: £1,837 (excluding nursing staff).
   (d) Total salaries and allowances of Medical Officers: £1,860.
   (e) Total annual sanitary expenditure: £622.

13. Towns under Municipalities or Town Councils:—
   (a) Number of such: 1.
   (b) Total population: 1,150; (Europeans 600, coloured 550).
   (c) Total revenues: About £1,000.
   (d) Total medical and sanitary expenditure: £750. Sanitary and scavenging service.

14. Table of deaths by districts: Only one death in the Northern Territory in 1913 was ascribed to malaria, and as a medical man did not see the patient the diagnosis is doubtful.

15. Table of deaths in the principal towns:—Town: Darwin. District where situated: Coast. Population of town: 1,150. No deaths from malaria during the year.

16. Rainfall during the year:—

Where observed.	District.	Rainfall.												
		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total
Darwin	Coastal ...	1583	755	1362	25	3	—	—	—	53	57	78	431	4347 points.

Rainfall diminishes as one passes inland until at 1,000 miles inland the fall is only about 6 inches per annum. Fall occurs always between September and April.

17. Additional information to be given if possible on the following points :—

(*a*) Is there any legislation in force against the breeding of mosquitoes in premises? Numbers of notices, convictions, and warnings during the year.—Regulations for effective drainage of premises, mosquito-proofing of water collections, cleansing of occupied and unoccupied allotments of tins, bottles, and other receptacles capable of holding water. Number of written notices served and complied with: 169. Innumerable verbal notices and warnings. No legal action required.

(*b*) Number of children examined for enlarged spleen. Where was this done? Percentage affected. Does kala-azar exist?—No systematic examination made. Enlarged spleen uncommon in hospital and private practice. No kala-azar observed.

(*c*) Number of persons examined for filarial diseases. Where this was done. Percentage affected.—No systematic examination. No cases of filariasis have occurred as far as is known. No elephantiasis has been seen.

(*d*) Any large works for surface drainage of towns or reclamation of marshes. Approximate cost.—Gradual reclamation of mangrove swamp is being carried out by filling in with town refuse.

(*e*) Numbers of men employed in towns and villages for petty anti-mosquito works. Approximate cost.—In Darwin one man is employed, with occasional black labour. Approximate cost £75 per annum.

(*f*) Amount of Government quinine sold or distributed gratis during the year. Agencies employed.—520 ozs. quinine distributed gratis. Medicine chests are sent out at Government expense and are placed in charge of responsible persons at bush stations and aboriginal depôts, etc. A book of instructions accompanies the chests, and the system is supervised.

(*g*) Is quinine distributed regularly in the schools?—No, unnecessary. No malaria has been observed amongst the school children.

(*h*) Measures taken against these diseases on estates employing indentured labour.—No indentured labour except on pearling luggers.

(*i*) Any steps taken regarding the housing of the poor?—At Darwin, provision is being made by the Government to house destitute Chinese and coloured people (Asiatics, Malays, Philipinos, South Sea Islanders, &c.) under good sanitary conditions outside the actual town. Aboriginals are provided for in a separate village.

(*j*) Any exceptional increase or decrease of these diseases recently noticed?—No. The diseases are not prevalent.

(*k*) Any other remarks on the subject.——

No. 15.

TRINIDAD.

RETURN OF MALARIAL FEVER, BLACKWATER FEVER, YELLOW FEVER, FILARIASIS, AND DENGUE DURING THE YEAR FROM 1ST JANUARY TO 31ST DECEMBER, 1913.

(Received 29th October, 1914.)

1. Name of Colony: Trinidad and Tobago.
2. Total area: 1,850 square miles.
3. Estimated population :—
   (*a*) Total 346,981

Appendix I.

REPORTS ON ANTI-MALARIAL MEASURES IN THE CROWN COLONIES AND PROTECTORATES, &c.

	(*b*) Europeans	not ascertained
	Other races	not ascertained
4.	Births during the year :—	
	Total births	11,576
5.	Deaths during the year :—	
	(*a*) Total deaths	8,245
	(*b*) Deaths ascribed to fever	916
	(*c*) Deaths ascribed to blackwater fever	nil
	(*d*) Deaths ascribed to yellow fever	2
6.	Government hospitals :—	
	(*a*) Number of such hospitals	9
	(*b*) Totals, during year :—	
	Admissions	12,686
	Deaths	1,583
	(*c*) Malarial fever :—	
	Admissions	1,091
	Deaths	56
	(*d*) Blackwater fever :—	
	Admissions	3
	Deaths	1
	(*e*) Yellow fever	nil
	(*f*) Filarial diseases :—	
	Admissions	40
	Deaths	nil
	(*g*). Dengue	nil
7.	Government dispensaries :—	
	(*a*) Number of such dispensaries	53
	(*b*) Total attendances during year	51,985
	(*c*) Attendances for malaria	8,448
	(*d*) Attendances for filarial diseases	96
	(*e*) Attendances for dengue	nil
8.	Medical service :—	
	(*a*) Number of Government Medical Officers	40
	(*b*) Number of special health officers	2
	(*c*) Number of other registered practitioners	37
9.	Schools :—	
	(*a*) Number of Government and State-aided schools ...	274
	(*b*) Number of scholars registered in these schools ...	47,700
	(*c*) Average daily attendances	28,034
10.	Estates employing indentured labour :—	
	(*a*) Number of such	121
	(*b*) Number of indentured immigrants employed ...	9,691
	(*c*) Number of hospitals and dispensaries on such estates	64
	(*d*) Total deaths among such labourers	178
	(*e*) Deaths ascribed to malaria	10
	(*f*) Total admissions and attendances at hospitals and dispensaries	21,701
11.	Estimated revenue of the Colony, 1913-14 :—	
	Total during year	£933,767
12.	Estimated expenditure of Colony :—	
	(*a*) Total during year	£953,645
	(*b*) Annual medical and sanitary expenditure	£84,900
	(*c*) Upkeep of Government hospitals and dispensaries...	£50,143
	(*d*) Total salaries and allowances of Medical Officers ...	£23,243
	(*e*) Total annual sanitary expenditure	£11,514
13.	Towns under Municipalities or Town Councils :—	
	(*a*) Number of such	3
	(*b*) Total population	72,587
	(*c*) Total revenues	$354,030
	(*d*) Total sanitary expenditure	$31,125

Appendix I.

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14. Table of deaths by districts :—

District.	Area in Square Miles.	Population, Census 1911.	Quarters, 1913.				Total, 1913.
			March.	June.	September.	December.	
Town of Port of Spain	*	59,796	459	421	441	439	1,760
Ward Union of St. Ann's ...	48,408	11,998	62	58	79	78	277
„ Diego Martin ...	53,739	17,923	81	94	95	100	370
„ Tacarigua ...	115,839	31,561	182	166	244	180	772
„ Blanchisseuse ...	64,886	1,433	4	5	4	4	17
„ Arima... ...	192,274	14,367	68	86	108	92	354
„ Toco	143,981	6,883	36	25	30	35	126
„ Manzanilla ...	195,453	18,289	72	75	87	110	344
„ Chaguanas ...	85,812	17,444	95	72	111	102	380
„ Couva	32,756	13,685	113	69	105	94	381
„ Montserrat ...	137,733	17,152	109	61	109	79	358
Town of San Fernando	*	8,667	117	95	143	158	513
Ward Union of Naparima ...	115,929	29,987	185	137	149	193	664
„ Savana Grande ...	280,583	34,157	176	154	234	193	757
„ Cedros	83,936	7,869	38	40	38	35	151
„ Oropuche ...	128,520	13,313	77	76	128	124	405
„ Mayaro	176,175	4,438	26	24	30	30	110
„ Tobago	114,395	20,749	117	90	149	130	486
Waters of the Colony	—	841	8	—	1	11	20
Total	—	333,552	2,025	1,748	2,285	2,187	8,245

15. Table of deaths in the principal towns :—

Town.	Area in Acres.	Population, Census 1911.	Quarters. 1913.				Total, 1913.
			March.	June.	September.	December.	
Port of Spain	1,338	59,796	459	421	441	439	1,760
San Fernando	670	8,667	117	95	143	158	513
Arima	588	4,020	37	45	47	50	179
St. Joseph†	—	—	50	20	27	43	140
Total	—	—	663	581	658	690	2,592

16. Rainfall during the year :—
Mean rainfall for twelve months at 94 stations ... ... 63·54 inches

17 (*a*). Is there any legislation in force against the breeding of mosquitoes in premises?
Yes; Regulations under Section 8 of the Public Health (Special Powers) Ordinance No. 188.
Number of notices served, 1,403.
Number of prosecutions, 180.
Number of convictions, 161.
Number of warnings, no record kept.

(*b*) Number of children examined for enlarged spleen : 17,495.
Where was this done? Throughout the Colony.
Percentage affected : 17·91 per cent.
Does kala-azar exist? No.

(*c*) Number of persons examined for filarial diseases.
Persons are not specially examined for filarial diseases. There were, however, 40 admissions, with no deaths, in nine Government hospitals in different parts of the Colony.

* Given separately. † Not ascertained.

(*d*) Any large works for surface drainage of towns or for reclamation of marshes? None.

(*e*) Number of men employed in towns and villages for petty anti-mosquito works. Approximate cost.

A gang of six men were employed during the year for petty anti-mosquito work in the town of Port of Spain, at an approximate annual cost of $648.

(*f*) Amount of Government quinine sold or distributed gratis during the year.

Government quinine is not distributed gratis, and it is very difficult to ascertain the amount of quinine sold all over the island.

(*g*) Is quinine distributed regularly in the schools?

Quinine is not distributed in any schools.

(*h*) Measures taken against these diseases on estates employing indentured labour.

Some few estates provide for quinine distribution, but not systematically.

(*i*) Any steps taken regarding the housing of the poor.

A Government house of refuge or poor house is established in Port of Spain, accommodating 462 paupers, for whom medical attendance is afforded by one of the Medical Officers of Port of Spain.

APPENDIX II.

Reports of the Professor of Protozoology at the University of London, and of his Assistant, for the Year ended 30th June, 1914.

No. 1.

REPORT OF THE PROFESSOR OF PROTOZOOLOGY AT THE UNIVERSITY OF LONDON, FOR THE YEAR ENDED 30TH JUNE, 1914.

(Received 3rd November, 1914.)

My work during the year covered by this report has been carried on at the Lister Institute without interruption, other than the usual vacations.

Miss Muriel Robertson returned from Uganda (where she has been at work on problems connected with sleeping sickness and other trypanosomiases during the past three years; see [Cd. 6024], p. 70) in March last, and resumed her former position as my assistant. There are no other changes to report with regard to the *personnel* of this department.

The account of my work during the year may be divided conveniently into (1) research, and (2) teaching work.

1. *Research.*—My chief work this year has been the completion, in collaboration with Dr. J. D. Thomson, of our joint investigations into the development and transmission of *Trypanosoma lewisi* in and by its intermediate host, the rat-flea; investigations upon which we have been engaged intermittently for the last five years. The complete memoir, embodying all our results and fully illustrated, has been sent for publication to the *Quarterly Journal of Microscopical Science*, where, we hope, it will have appeared before this report is published. After an introduction (Part I.), in which we describe our technique and give an account of the anatomy and histology of the flea and other subsidiary questions, the main body of our memoir is divided into two parts (II. and III.), the first containing the full account of our observations upon the development of the trypanosome in the flea, the second consisting of experimental results with regard to the transmission by the flea and other kindred problems. Roughly speaking, Part II. of our memoir contains the results of *observation*, Part III. the results of *experiment*; but the distinction is not an absolute one, since the one method of investigation is controlled and checked by the other throughout.

The development of the trypanosome in the flea is described under its two principal phases, corresponding to the regions of the digestive tract in which it takes place, namely, the stomach-phase and the rectal phase. The first of these two phases begins very soon after the trypanosome is taken into the stomach, when the flea sucks the blood of an infected rat.

In the stomach-phase the parasite retains the typical trypanosome-type of structure, and only becomes crithidial in character under very exceptional circumstances. It penetrates into the epithelial cells of the flea's stomach, and reproduces itself by a process of multiple fission within the cells, whence the daughter-trypanosomes produced (usually a dozen or more in number) break out and return to the stomach-cavity. They may then enter into other epithelial cells again and repeat the process of multiplication, or they may pass backwards out of the stomach and initiate the rectal phase. The trypanosomes never multiply when free in the stomach-cavity, but only within the epithelial cells, by multiple fission. We have studied in full detail the effects produced by the trypanosomes upon the epithelium of the stomach.

The product of the intracellular multiplication in the stomach is a long, active form of trypanosome, which we have designated "crithidiomorphic," because, while it lacks the diagnostic feature of the crithidial form (inasmuch as the kinetonucleus is situated well behind the trophonucleus), it nevertheless has crithidial characteristics in form and movement, especially in its stiff, more or less distinctly club-shaped body, very different from the flexible, sinuous body of the trypanosome which occurs in the rat and initiates the development in the flea.

The rectal phase might perhaps be termed with greater propriety the proctodæal phase, because, although the parasites in this phase of the development are found most usually in the rectum (the hindermost part of the proctodæum), they occur frequently in the intestine connecting the stomach and rectum, especially in its anterior region immediately behind the pylorus. Some experiments conducted by Dr. Thomson (XIX. in Part III., see below) have shown that the differences to be observed in the position occupied by the parasites in this second phase can be correlated with the condition of the host. If the flea is kept on the rat, and so has

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access to abundant food, the parasites are found in the rectum; if, on the other hand, the flea be starved and allowed to feed only at long intervals, the parasites tend to migrate forwards and attach themselves round the pylorus, the opening of the stomach into the intestine.

The rectal phase is initiated by the long, active "crithidiomorphic" trypanosome-form described above, which migrates from the stomach to the proctodæum. In spite of a great deal of laborious investigation, we have not been able to satisfy ourselves with regard to the exact manner in which the transition from the stomach-phase to the rectal phase is effected. This point still remains open for decision by future investigations. All that can be stated at present with certainty and unanimity is that the relatively large trypanosome-form which comes down from the stomach multiplies by repeated binary fission, a process that results finally in the production of a number of small crithidial forms, very much smaller than their progenitors, the trypanosomes of the stomach-phase. This transformation appears (from the rarity of transitional forms in fixed preparations) to take place very rapidly, and apparently also in relatively few of the numerous trypanosomes which come down from the stomach.

However the rectal phase takes origin, it consists, in its fully established form, of small individuals of the typical crithidial structure, that is to say, with the kinetonucleus moved forwards so as to lie beside, or in front of, the trophonucleus. The crithidias are found in the cavity of the rectum or intestine, and never penetrate into the epithelium; they multiply continually by binary fission. Two well-marked types of crithidias can be distinguished. The one, for which we adopt Woodcock's term "haptomonad," is typically pear-shaped, with the free flagellum very short, or wanting altogether; it is attached by the flagellar end of the body to the cuticle lining the proctodæum and multiplies actively by binary fission. The other, which we term the "nectomonad" type, has usually a long and slender body, with a long, free flagellum; it is found swimming freely in the cavity of the proctodæum. All possible transitions are to be found between the two extreme forms, which are to be regarded as functional phases of the parasites. There can be no doubt that a haptomonad can develop into a nectomonad, loose itself from its attachment, and swim away, and that, conversely, a nectomonad can attach itself to the cuticle, develop into a haptomonad, and start to multiply. The function of the haptomonad form is multiplicative, that of the nectomonad migratory, and it is in the nectomonad condition that the parasites change their venue in the manner above described.

From the crithidial forms in the proctodæum arise the small trypanosome-forms which are the final form of the development in the flea, and which are destined to pass into the rat and produce a fresh infection in the vertebrate host. The final form is produced by a transposition of the two nuclei of the crithidia; the kinetonucleus passes back to the extreme hinder end of the body, and in relation to this displacement a shallow undulating membrane is formed, running the whole length of the body of the parasite. We have never observed any multiplication of these final forms.

With the production of the little trypanosome-form, the developmental cycle in the flea is ended. It remains only to state that the stomach-phase of the development is usually of short duration, sometimes completed in twenty-four hours or less, and that it probably does not persist in any case beyond the second feed of the flea (Part III., XVII., see below). On the other hand, when once the crithidial phase is established in the proctodæum, it probably maintains itself there as long as the flea lives; the haptomonads multiply continually, and the surplus population becomes transformed into the final infective trypanosome-forms which pass out of the flea.

In addition to the *developmental* series of forms, constituting the life-cycle described in the foregoing paragraphs (see also [Cd. 6669], pp. 71, 72), there is also a *degenerative* series to be reckoned with, since, as explained in a former report ([Cd. 6669], pp. 69, 70), the trypanosome fails to establish itself in a large percentage of the fleas fed on infected rats, and in any such flea many of the trypanosomes taken into the digestive tract of the flea do not develop but degenerate and

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die off. The process of degeneration is described in detail in our memoir, and it is not necessary to deal with it fully here; I may content myself with remarking that the frequent co-existence of developmental and degenerative forms of the trypanosome in the fleas increased greatly the difficulty of piecing together the connected story of the life-cycle of the parasite in the flea.

In setting forth our experimental results, we have first given a short introduction describing our methods, technique, apparatus, etc., and then have stated a series of nineteen propositions, placed as headings, each followed by a detailed account of the experiments on which the proposition is founded. If we consider the proposition thoroughly proved, it is stated in the affirmative; if further evidence is required to demonstrate it absolutely, it is written in the interrogative form. In order, therefore, to give an abstract of our experimental results, it is sufficient to quote our nineteen propositions, as follows :—

I.—*Trypanosoma lewisi* is transmitted from rat to rat by the rat-flea *Ceratophyllus fasciatus.*

II.—The transmission takes place by the cyclical method. Transmission by the direct method has not been proved to occur.

III.—The trypanosomes make their appearance in the blood of the rat five to seven days after infection; the multiplication of the trypanosomes in the blood of the rat comes to an end eleven to thirteen days after infection.

IV.—The cycle of development in the flea requires a minimum of five days for its completion.

V.—Transmission is never effected until the developmental cycle is completed; that is to say, until at least five days have elapsed since the first exposure of the fleas to infection.

VI.—The infection of the rat is brought about by the small trypanosome-form, which is the final form of the development.

VII.—The final infective form of the cycle is developed first in the rectum on the fifth day of the developmental cycle, but may appear later in the stomach.

VIII.—The developmental forms of the trypanosomes in the flea are not infective when inoculated into the rat during a period extending from a short time (half an hour?) after being taken up by the flea until the developmental cycle is complete.

IX.—The flea, when once it has become infective, remains so for a considerable length of time.

X.—The trypanosome does not penetrate into the salivary glands of the flea, but is confined, during its whole development, to the digestive tract.

XI.—The rat can become infected by eating infected fleas; but not until the developmental cycle of the trypanosome in the flea is completed.

XII.—Infection of the rat is effected contaminatively, by way of the rat's mouth, by the rat licking from off its fur or skin the moist fæces of infective fleas containing the final propagative form of the life-cycle.

XIII.—Can the flea infect the rat by inoculating the trypanosomes into it through the proboscis? [The answer to this question is in the negative for all practical purposes.]

XIV.—Hereditary transmission of the trypanosome from flea to flea does not, in our experience, take place.

XV.—The trypanosomes in the blood of the rat can render fleas infective very soon after they make their first appearance in the blood, before their multiplication period is over.

XVI.—The trypanosomes succeed in establishing themselves in the flea, and rendering it infective to the rat, in only a small proportion of the fleas that ingest them.

XVII.—Can the first phase of the development of the trypanosomes, namely, the intracellular multiplication in the stomach of the flea, continue beyond the second feed of the flea (counting as the first feed that by which it became infected)? [Our experiments indicate an answer in the negative.]

XVIII.—Starvation of the flea during the incubation period of the cycle does not inhibit, nor does it necessarily retard, the developmental cycle of the trypanosome in the flea.

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XIX.—Starvation of the flea following immediately on an infective feed favours the establishment of the haptomonad phase in the rectum, while starvation begun after the incubation period in the flea is over favours migration to the post-pyloric end of the intestine, and the establishment of the haptomonad phase there.

The above is a summary, necessarily brief, of our published results. Two small points require brief further mention. When I was in Paris in the beginning of 1913, Dr. E. Chatton, of the Pasteur Institute, very kindly gave me some living fleas (*Ceratophyllus fasciatus*) which contained a pure infection of *Leptomonas pattoni.* This flagellate is regarded by most authorities as a specific parasite of the flea alone, not related to any parasite of the rat or any other vertebrate. It can be asserted, definitely, at least, that this leptomonas is not related in any way to *Trypanosoma lewisi* of the rat. I started a breeding-cage with the leptomonas-fleas given me by Dr. Chatton, and they bred and multiplied enormously, but none of the rats put in to feed them ever showed any infection with trypanosomes, although examination of the swarming fleas showed that about 50 per cent. of them contained teeming infections of the leptomonas in the hind-gut. We were able, therefore, to make preparations of the leptomonas and to compare these parasites with the stages of *T. lewisi* in the flea.

Recently, however, some very remarkable results have been obtained by Drs. Laveran and Franchini at the Pasteur Institute. They experimented also with leptomonas fleas obtained from Dr. Chatton, and found that rats or mice exposed to the attentions of the fleas acquired an infection of *Leishmania* (*Comptes Rendus Acad. Sci., Paris*, CLVIII., p. 450). This throws an altogether new light on the significance of *Leptomonas pattoni* in fleas, and shows that, in order to prove that a flagellate parasite of an insect is a parasite of the insect alone, it is not sufficient to prove merely that it has no connexion with any trypanosome parasitic in vertebrates.

With the assistance of Miss Lodge, who is working in my laboratory, I have been carrying on some experiments in order to ascertain whether rats which have been in contact with leptomonas fleas, and which therefore may be presumed* to have acquired an infection with *Leishmania*, can produce, in their turn, a leptomonas-infection in clean fleas with which they are brought into contact; that is to say, whether the *Leishmania* and the leptomonas are simply two stages of one and the same parasite, which goes through a regular alternation of generations in the rat and in the flea, in a manner similar to the trypanosome *T. lewisi*. These experiments have not so far yielded a positive result, but are being continued.

The second point to be mentioned is that in the course of our investigations Dr. Thomson and I found many cysticercoids in the fleas dissected, lodged in all cases in the body cavity. In a former report ([Cd. 6024] p. 76 and p. 83), I have mentioned that Dr. Nicoll and myself published a note in the *Proceedings of the Zoological Society* describing two species of cysticercoids in rat fleas. We (Dr. Thomson and I) have now found a third form, which resembles the form with hooks formerly described, but has no hooks; it may be a young stage, in which the hooks are not formed, of the hooked form, or it may be a third species. I am handing over the specimens to Dr. R. T. Leiper, of the London School of Tropical Medicine, for study, as I have no claims to be an expert helminthologist.

In addition to the joint investigations upon *T. lewisi*, I have been engaged in other works of smaller compass. I was invited to contribute a short memoir to a volume to be published in honour of Dr. E. Metchnikoff, of the Pasteur Institute, to celebrate the jubilee of his activities as a scientific investigator. I wrote a paper on the significance of the so-called "Infective Granules" of Trypanosomes, and sent it to Professor F. Mesnil, who acknowledged the receipt of it and accepted it for the volume in question. I have not yet, however, received the proofs to correct.

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* Since the leishmanial parasites are lodged in the internal organs of the rat, their presence cannot be ascertained without killing the rat. Miss Lodge has made a prolonged search of the blood of rats exposed to leptomonas fleas without finding any leishmanias in the blood.

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Much against my will, I have been drawn into a polemical discussion on the nature of the bodies known as blepharoplasts (No. 1 in the list of publications appended below).

2. *Teaching Work.*—During the months of January, February, and March, 1914, I gave a course of twelve lectures on the "Protozoa Parasitic in Man," at the Lister Institute, on Tuesdays and Fridays at 5 p.m. Each lecture was followed by a demonstration of microscopical preparations illustrating the subject of the lecture. The average attendance at the lectures was about 25.

I also gave (by permission of the University) a course of five lectures at the Horniman Museum, Forest Hill (under the auspices of the London County Council), on "The Protozoa and their Importance to Mankind," on Saturday mornings at 11.30 (25th April, 2nd, 9th, 16th, and 23rd May). The attendance was good and did not fall off.

I attended the meeting of the British Association at Birmingham last summer (1913), and gave there a public lecture on "Some Aspects of the Sleeping Sickness Problem," with lantern slides. There was a very full attendance, and after the lecture I replied to numerous queries put by members of the audience.

Having been requested to give evidence before the Departmental Committee on Sleeping Sickness, I forwarded to the Committee a written statement, embodying my views on certain points, and on 4th November I attended personally before the Committee and gave evidence (see [Cd. 7350], pp. 60-70, and pp. 270, 271).

A number of workers have occupied places in my laboratory during the year, and have received informal help or advice from me or my assistants.

Dr. Thomson, as stated above, has been collaborating with me in the study of *Trypanosoma lewisi.*

Dr. Bosanquet has been working intermittently on various subjects, more especially on fish parasites of the order Myxosporidia.

Major Perry, I.M.S., who was mentioned in my last report ([Cd. 7261], p. 76), left us in November, 1913.

Mr. G. Lapage (see also my last report) continues his collaboration with Dr. Woodcock, and visits the laboratory occasionally; Mr. C. H. Martin and Mr. E. Heron-Allen also visit us from time to time.

Mr. and Mrs. Goodrich (formerly Miss Helen Pixell) worked here during one vacation on various protozoa, more especially on the genus *Aggregata*, parasites of cephalopods, on which Mrs. Goodrich has published a memoir (No. 8, below).

Major Harvey, I.M.S., who came here in April last, has been studying technique and protozoa generally; so also Dr. R. G. White, of the Public Health Department, Cairo; Mr. H. G. Thornton, of New College, Oxford; and Major S. L. Cummins, Professor of Pathology, Royal Army Medical College.

Miss Olive Lodge, Demonstrator of Zoology at the Birkbeck Institute, has joined this laboratory, and works here in the leisure time left her by her official duties. I have mentioned above her experiments on the leptomonas fleas; she is also engaged with Dr. Woodcock in working out the collection of protozoa made by Surgeon E. L. Atkinson on the Scott Antarctic Expedition.

In addition to assisting those who work in my laboratory, I correspond with various people at home or abroad who consult me with regard to protozoological problems; amongst whom I may mention especially Captain F. P. Mackie, I.M.S., on special duty with the kala-azar inquiry, and Dr. Castellani, Colombo.

Appended will be found a list of works published from this Department during the year covered by this report.

In conclusion, and although it does not fall strictly within the time covered by this report, I should like to be permitted to state that, with the permission of the University, I attended the meeting of the British Association held in Australia this summer, as a vice-president of Section D (Zoology). I left England on 3rd July, 1914, but my return was delayed by the outbreak of war; the steamer on which I should have returned was taken for troops, and the route across France via Marseilles was closed. Consequently, I was unable to reach London before 17th October. For this reason the preparation and presentation of this report has been delayed beyond the usual time.

E. A. MINCHIN.

Appendix II.

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List of Publications relating to Investigations carried on wholly or in part at the University Department of Protozoology.

By Professor E. A. Minchin :—

(1) Remarks on the nature of the blepharoplasts or basal granules of flagella. *Archiv für Protistenkunde*, Vol. XXXIV, pp. 212-216.

By Dr. H. M. Woodcock :—

(2) On "*Crithidia*" *fasciculata* in hibernating mosquitoes (*Culex pipiens*) and the question of the connexion of this parasite with a Trypanosome. *Zool. Anzeiger*, Vol. XLIII., pp. 370-382, 41 text-figg.

(3) Further remarks on the flagellate parasites of Culex. Is there a generic type, Crithidia? *Zool. Anzeiger*, Vol. XLIV., pp. 26-33, 1 text-fig.

(4) Protozoa. *Zool. Record*, Vol. XLIX., 62 pp.

By Dr. H. M. Woodcock and Mr. G. Lapage :—

(5) On a Remarkable New Type of Protistan Parasite. *Quarterly Journal of Microscopical Science*, Vol. LIX., pp. 431-457, plates xxix., xxx.

By Mr. T. Goodey :—

(6) A Preliminary Communication on three new Proteomyxan Rhizopods from Soil. *Archiv für Protistenkunde*, Vol. XXXV., pp. 80-102, plates v.-viii.

By Mrs. E. S. Goodrich (Miss Helen Pixell) :—

(7) Notes on *Toxoplasma gondii*. Proceedings of the Royal Society, (B), Vol. LXXXVII., pp. 67-76, plate ix.

(8) The Sporogony and the Systematic Position of the *Aggregatidæ*. *Quarterly Journal of Microscopical Science*, Vol. LX., pp. 159-174, plate xiii.

By Messrs. C. H. Martin and K. R. Lewin :—

(9) Some Notes on Soil Protozoa. *Phil. Trans.*, (B), Vol. CCV., pp. 77-94, plates v., vi.

No. 2.

REPORT BY H. M. WOODCOCK, D.Sc. (Lond.), ASSISTANT TO THE UNIVERSITY OF PROTOZOOLOGY, ON WORK DONE DURING THE YEAR ENDING 30th JUNE, 1914.

My work during the year under review may be considered under the two headings of: (A) Research; and (B) Assistance to the Professor and in the Department.

(A). Research.

My work has dealt with the following three subjects :—

(1) *Flagellates occurring in the common British mosquito, Culex pipiens.*— In my last report (*vide* Cd. 7261, March, 1914), I described my observations of certain flagellates in the intestine and rectum of hibernating females of *C. pipiens;* these flagellates I regarded as "*Crithidia*" *fasciculata* Léger, as had been done formerly by Novy, McNeal, and Torrey. Very soon after writing my last report, I was fortunate in finding the cysts of this parasite, which had not been previously observed. The cysts are similar in type to those described in the case of certain other flagellates of insects. I have published an account of my observations (No. 1, below). In a subsequent note (No. 2), I have discussed the question of the distinction between the forms known as *Leptomonas* and *Crithidia*, and the manner in which these two important generic types are to be defined, in view of the confusion still prevalent, even among writers who ought to know better. I point out clearly that, in the "resting," attached phase of either of these parasites, for which I propose the term *haptomonad* phase, it cannot be determined from that phase alone to which type a particular parasite belongs; since, in the case of both, the haptomonad phase is similar as regards appearance and morphology. Only

when the parasites are in the active, monadine condition (the *nectomonad* phase, as Minchin has proposed to term it), can it be decided to which of the above types they belong. In my second note I give the reasons which lead me to consider that the parasites found by myself and the American workers previously are best regarded provisionally as Leptomonad rather than Crithidial forms, and should therefore be termed *Leptomonas fasciculata* (Novy, McNeal and Torrey).

One very interesting and important point, which is nevertheless difficult to decide from the data yet available, is whether these parasites of *Culex* are to be considered as solely parasitic in the mosquito, or as connected with some Hæmoflagellate (probably an Avian Trypanosome). The occurrence of cysts in an insectan flagellate is, on *a priori* grounds, an indication of *contaminative*, as opposed to *inoculative* infection of a fresh host; and therefore it might be concluded that such a parasite is a purely insectan form. I have discussed the question fully in my notes, taking into consideration the case of *Trypanosoma grayi*, of the crocodile and tsetse-fly. It should be borne in mind that it is by no means improbable that, in certain cases, e.g., *T. grayi*, a hæmoflagellate, descended from what was originally a purely insectan parasite, may have *retained the ability to produce cysts* in the invertebrate, to aid in transmission or dispersal. I will add only that if these Leptomonads of *C. pipiens* are indeed purely insectan parasites, it remains a very remarkable fact that none of the early larvæ, nor any of the early summer mosquitoes examined, were infected, in spite of the heavy infection of the hibernating females (*vide* Report, l.c., p. 80). Moreover, the hibernating females examined again last autumn (1913) were, on the other hand, very rarely infected, and I cannot help thinking this condition perhaps stood in relation to the fact that the birds (chaffinches) I examined during the early part of that year were also surprisingly free from any trypanosome-infection—more so than I have previously known them to be. Unfortunately the question must remain undecided for the present.

(2) *The development of the Trypanosome of the Little Owl* (*Athene noctua*) *in the mosquito* (*C. pipiens*). I have hitherto postponed the full study of my preparations and the completion of the account of my observations made at Rovigno on this important subject, because I hoped before now to obtain the corresponding development, and moreover the actual transmission back again to the bird, of *T. fringillinarum*, here in England, in order to round off the whole subject. This last-named part of the research progresses, unfortunately, very slowly, owing to the great difficulties in the way, so that I came to the conclusion it would be useful to publish the observations I had, without waiting longer, more especially as the only other worker who has written anything of late upon the subject, namely, Mayer, in his account of the parasites of another owl (*Syrnium aluco*), continues to uphold Schaudinn's view and to maintain that the flagellates occurring in mosquitoes which have fed on an owl are developed from the halteridia and leucocytozoa present in the blood. In my "Notes on Sporozoa," No. IV. (*vide* last Report, Paper No. 2), I showed clearly that, considered from the standpoint of these intracellular parasites, everything is against such a connexion of either with a trypanosome. And the evidence which I have now brought forward, dealing with the question from the standpoint of the actual development of the trypanosomes in the mosquito, is equally negative and does not bear out Mayer's contention in the slightest degree.

I proceed to give a brief resumé of my principal observations and conclusions; the paper will be published in the Quart. Journ. Micr. Sci. in the course of a few weeks.

(*a*) Experimental observations. In mosquitoes fed on an owl which had a good infection of *Halteridium*, in the form of ripe gametocytes, but which contained the trypanosomes in the blood, numerous well-developed ookinetes were found. Several of these were watched for considerable periods, at the time when, according to Schaudinn, their transformation into flagellates takes place, but in no instance was the least sign of such a phenomenon observed. Similarly, in mosquitoes fed on an owl containing only Leucocytozoon, only the large ookinetes of this parasite were found. On the other hand, in no less than 45 per cent. of

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the mosquitoes fed on an owl in which *Trypanosoma noctuæ* was known to be present in the blood, characteristic developmental phases (crithidial and trypaniform flagellates) were found. As I have shown, alone and in collaboration with Minchin, in previous papers, the only form of the trypanosome present in the blood of the birds with which I have worked, whether owls or chaffinches, during the early summer-time, is of a very definite type, stumpy and fusiform and relatively stout; I have never found this form at any other period. Moreover, the parasites were—for avian trypanosomes—not at all infrequent, whereas at other times of the year, *e.g.*, in winter and early spring, they are excessively scarce in the general circulation, and may even not be present at all, so far as can be ascertained. I have never seen the slightest indication of these developmental phases of the trypanosome in any bred-out mosquito fed on a bird which did not contain this stumpy form of the trypanosome in the general circulation at the time—whether the bird was infected with *Halteridium*, or *Leucocytozoon*, or with neither! Therefore, as was clearly pointed out by Minchin and myself in our paper three years ago, a characteristic form of the trypanosome is present in the blood during the early summer, which constitutes a definite transmissive phase (*vide* Report for 1911 [Cd. 6024], p. 78). I wish to emphasize that we were the first to show this important fact, namely, that a trypanosome in the blood of the vertebrate host may have such a definite transmissive form, for infecting the invertebrate, just as a definite transmissive phase is now known to be developed regularly in the invertebrate, for the infection of a fresh vertebrate; because Nöller, in a recent note on this question, has entirely overlooked our work.

(*b*) The course of the development undergone by the trypanosome in the mosquito. In studying the different forms observed, a comparison with the course of the development of *Trypanosome fringillinarum*, of the chaffinch, in cultures, as I described it some years ago, has been most instructive; and for this reason. In the mosquito, digestion goes on fairly rapidly and is completed, in favourable conditions, in 3 to 3½ days. Correspondingly, the development of the parasites is rapid, and the various modifications in form are passed through hurriedly, and the final types soon attained. Hence actual stages in the division of intermediate forms, a knowledge of which, for instance, assists greatly in the correct interpretation of the sequence of the developmental changes, are very hard to catch. On the other hand, in the culture-tube, there is no absorption of the medium and consequently not the same stimulus to the production of the final forms. Hence, until the medium becomes too full of toxic products for the parasites to thrive, the trypanosomes persist, for the most part, in the multiplicative (crithidial) phase and go on dividing actively. Now the different phases of the trypanosome which I have observed in the mosquito agree essentially with those which I had previously found in cultures. Hence, on the one hand, the determination of the mode of origin and the course of development of the various forms in the mosquito has been greatly facilitated; and, on the other hand, I am now able to say with confidence that the cultural development, at any rate so far as avian trypanosomes are concerned, *does* correspond, in the main, with the natural development in the insectan host, and may certainly be regarded as furnishing a general indication of the latter. The differences found are largely due to the different conditions prevailing in the environmental medium, just alluded to. The account given in my paper provides, I believe, the most detailed comparison between the course of the cultural and of the natural development (in the invertebrate host) which has yet been brought forward in the case of a trypanosome.

The development in the mosquito proceeds along two distinct lines, which culminate in the production of two extreme types with different functions. The earliest forms found are trypanomonad (crithidial) individuals, of a typical character. Along one line of development, these forms pass into trypaniform individuals, by a progressive modification of the body-form and a change in the relative position of the nuclear organellæ. Not to enter into descriptive details here, I will merely say that the end-result of the process is an extremely long, attenuated—almost "spirochætiform"—trypanosome, which has a remarkable appearance. In stained preparations it is seen that the trophonucleus is greatly

elongated and ladder-like, *i.e.*, it consists of a number of karyosomes, which have the form of short rods, transversely arranged. I have no doubt that this final type represents the inoculative phase, *i.e.*, the form in which the parasite is transmitted back again to a fresh vertebrate host (owl). Unfortunately, I was not able to prove this by the actual infection of a bird; but from a comparison of what is known with regard to piscine trypanosomes, this conclusion can be regarded as certain. From Minchin's work on piscine forms, as they occur in fish, and from mine on avian forms, as they are found in birds, it is clear that both these groups of trypanosomes are closely related. There is the same pronounced polymorphism in type, due to the very varied form at different periods of growth; and, moreover, the two sets of forms agree very closely in morphology and appearance at the different stages. These two groups together form a division quite distinct, for example, from all mammalian trypanosomes. Again, that part of the life-cycle of piscine trypanosomes which is passed through the invertebrate host (some leech), as described by Miss Robertson, shows just the same types of form as I have found in the case of *T. noctuæ* in *Culex*. The important point is that the propagative (inoculative) phase developed in the leech is of a fundamentally similar type to that above described, the only difference being that it is not quite so remarkably attenuated and thread-like.

The other line of development is initiated from certain of the ordinary crithidial forms in which the nuclear division has been slightly oblique, with the result that in some daughter-individuals the two nuclei are not in the middle of the body, as is usual at first, but tend to be in the posterior half. Such individuals give rise to the characteristic "club-shaped" forms, with both nuclei distinctly in the hinder, swollen part of the body. These then undergo markedly unequal division, and by this means numbers of small, pear-shaped forms are developed, which possess only a short flagellum and practically no membrane. From these in turn, the other extreme type is produced, namely the *haptomonad* forms, which become attached to the wall of the alimentary tract—probably, in this case, chiefly of the stomach—and constitute the reserve stock of the parasite in the mosquito. This is as far as I have been able to carry my observations of the life-cycle, but there can be no doubt that, under favourable conditions, *e.g.*, a fresh meal of blood, these haptomonads are able to give rise to a fresh succession of active crithidial forms, which can, in their turn, produce again trypaniform, inoculative individuals.

Through every period during the course of the development, as I have observed it, the trypanosomes retain the characters of a typical binucleate flagellate; at no time is there the least indication of any direct affinity with the hæmosporidian parasites, any more than there is in the case of the development of piscine trypanosomes, with hæmogregarines! And, on the other hand, I have studied carefully the structure of the ookinetes of *Halteridium* and *Leucocytozoon*, as they occur in my preparations, and can say with certainty that they are *not* binucleate, and do not show any sign of developing into a flagellate form. I had already arrived at this conclusion from my detailed study of the cytology of these parasites in the blood of the bird (*vide* Cd. 6669, p. 75). I think, therefore, as a result of these studies, I may claim not only to have actually disproved the view of Schaudinn, that the trypanosomes of the little owl are ontogenetically connected with the hæmosporidian parasites, a view which has been long supported by German workers, but also to have shown the main outlines of the development of avian trypanosomes, in the birds, in the mosquito (where this is the transmitting host), and in cultures.

(3) *Living observations on the life-history of a new type of Flagellate, Helkesimastix fæcicola, together with remarks on the question of conjugation in the Trypanosomes.* In this interesting and important work, I have had the assistance of Mr. Lapage, M.Sc., of Manchester University. This new flagellate is a "passenger" in an encysted condition, through the alimentary tract of sheep and goats. In moistened dung, the creature is liberated from the permanent cyst, by a dissolution of the cyst-wall. We have cultivated the flagellate on various special media, on which it thrives amazingly. By means of special observation-preparations

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we have been able to observe in life the whole course of the life-cycle. We consider that the dissolution of the cyst-wall is due to the secretion of some enzyme or ferment by one or more particular species of ærobic bacillus, which are always present in the dung and in the cultures. In preparations to which air is not admitted there is no development of these bacilli and the flagellates never emerge from their cysts. The principal morphological characteristic of this new flagellate is that it possesses a single flagellum, inserted at the anterior end of the body, but always directed backwards, like a trailing flagellum, and usually closely applied to the body. There is no kinetonucleus, and no attaching membrane has been developed. There is no definite mouth-aperture, and we are very doubtful whether the creature actually ingests bacteria. We consider that the principal mode of nutrition is by osmosis; *i.e.*, *Helkesimastix* is a saprozoic form. The most remarkable and characteristic method of locomotion is a steady gliding movement. This is seen when the flagellate is at the upper surface of the medium; when it is thus gliding along, the flagellum lies on the dorsal side of the body, and trails passively behind, not acting in any way as a pulsellum. We think surface-tension is most probably concerned in this mode of movement.

Life-cycle.—As soon as the flagellate has emerged from its cyst, a short period of vegetative activity and growth ensues, and then multiplication begins. Division is always by equal binary fission. We have been able to observe the entire process. After two or three days of rapid multiplication, when the flagellates simply swarm in the cultures, an epidemic of conjugation sets in. The vast majority of the flagellates normally conjugate. We have been able to watch the complete process. This phenomenon has been actually observed in the case of these lowly flagellates by only one other worker (Dobell), since the able research of Dallinger and Drysdale, many years ago. Two conjugating individuals (gametes) unite by their lateral surfaces to form a biflagellate "zygote." Although cytoplasmic union is thus accomplished, a long period elapses before the zygote assumes a definite body-form and the nuclear fusion takes place. At first, owing to the looseness of the union, the behaviour of the two united gametes is amazing, and we believe, unique in the history of conjugating elements. Owing partly to the fact that the protoplasm of this form is very plastic, and partly to the fact that there is at first no attraction, apparently, between the two nuclei (this being probably because no nuclear maturation has yet taken place), the two gametic halves behave just as they like for some time. One will "slither" in front of, or behind, the other, and the two may even separate for some distance, remaining connected only by an extremely thin cytoplasmic thread. But, once joined, we have never seen the two gametes actually break loose from one another, and do not believe this ever occurs.

Ultimately, the zygote assumes a characteristic form, which we have called the banner-stage, because it is exactly like a procession-banner, with the two flagella as the standards or poles. This gradually changes to an ovoid form, which persists for some time. During this period, the two flagella are gradually becoming shorter, being slowly absorbed by the zygote. During this time, we consider that the nuclear changes leading up to the actual nuclear union, take place; but as we have restricted ourselves to living observations, up to the present, we cannot say with certainty until we have studied permanent preparations. Finally, the zygote comes to rest, becomes rounded-off and loses its flagella. It now encysts, forming first a "shrinkage"-cyst, which after a time passes into the permanent one. This completes the life-cycle. It remains only to add that the zygote never continues to multiply in the active condition, but always encysts. Also, we are convinced that every cyst formed is the product of an act of syngamy. There is no multiplication within the cyst, from which, as stated above, only a single individual emerges.

Biological questions.—We have found that if a subculture is made from a culture in which the flagellates are actively multiplying, before conjugation has set in, multiplication will continue to go on for a further period of two or three days, after which conjugation, followed of course by encystment, then occurs. In the light of the interesting and important work done recently by Cropper and Drew on the biological factors causing the encystment of *Amœbæ*, we have no doubt that

the chief stimulus to the onset of syngamy (and subsequent cyst-formation) is to be found in the development in excess of toxic products in the immediate environment. This explains why, on making a fresh sub-culture of a small quantity of the flagellates on to a fresh (non-toxic) medium, multiplication continues actively. This is accompanied, of course, by an even more rapid bacterial development, and thus, in a few days more, the new medium is full to excess of toxic substances.

Now by continuing to subculture the flagellates at intervals of a few days, we have discovered a most interesting fact, which has, we consider, a highly important bearing upon the biology of the trypanosomes and other parasitic flagellates. Not only do the flagellates go on multiplying and multiplying, endlessly, without conjugating, but they are apparently *no longer able to conjugate* when left in a culture the medium of which is becoming full to excess of toxic substances. Up to the time of writing, we have kept such a "non-conjugating" strain going for more than three months, through about twenty subcultures, and in spite of repeated observations, in the course of which thousands of individuals have passed under our eyes, not a single cyst has been seen (*i.e.*, the normal product of conjugation). Instead of the vast majority regularly conjugating and forming cysts as in the normal and usual life-cycle, the flagellates have been propagated, through more than a thousand generations, solely by continuous multiplication. In old cultures the flagellates become altered and abnormal, and eventually all die off. This radical modification of the life-history is entirely due, we consider, to two factors :—(1) An abundant supply of nutriment, and (2) removal of the toxic substances, before these are present in excess in the medium. The essentially important point to note is that this strain has, so far as can be seen, lost the power to undergo syngamy. Left in an old subculture, becoming full to excess of toxic products, instead of conjugating and forming protective and quiescent cysts, the flagellates all die off!

In our paper on this flagellate, which has been communicated to the Royal Society, we show how this experimental fact affords the best explanation of why conjugation in the trypanosomes and other binucleate parasitic flagellates has been entirely lost, which we think is in all probability the case, as, in spite of numerous and careful observations, it has never been seen in any authentic instance. I will not develop the argument here but will merely say that the environment in which these parasites live is equally one in which the two above-mentioned factors operate; and, moreover, certain biological conditions which have been observed in trypanosomes (*e.g.*, involution and abnormal forms), agree closely with the corresponding conditions which we have found in the case of the non-conjugating strain of *Helkesimastix*, in old cultures.

(B). Assistance to the University Professor and in the Department.

As usual, I arranged the demonstrations in connexion with Professor Minchin's annual Course of Lectures, during the early Spring of 1913. The course was a most interesting one, on "The Protozoan Parasites of Man," and was very well attended. I have given considerable assistance to various workers in the laboratory, and have also given advice on many occasions to workers from laboratories abroad, on points in regard to which they desired information.

H. M. WOODCOCK.

10th August, 1914.

APPENDIX III.

Report on the Work of the Quick Laboratory at Cambridge for the year 1914.

REPORT OF PROFESSOR G. H. F. NUTTALL, F.R.S., ON THE WORK OF THE QUICK LABORATORY, CAMBRIDGE.

THE papers published by the workers in the Quick Laboratory during the year 1914 (of which a list is appended) relate to the structure and biology of ticks and their pathogenic action, to pathogenic protozoa, and to serological studies.

The work of the Laboratory has been considerably disturbed by the outbreak of war. Moreover, both Dr. Hindle and myself have been busily engaged in writing books and various papers which will shortly be published. The number of papers issued from the Laboratory is, for these reasons, diminished as compared with the output of previous years. Several changes have also occurred in the staff and a number of its members have joined the Army temporarily.

Mr. Gordon Merriman (Trinity Hall), who held the studentship in Medical Entomology for several years, was killed in action near Karonga, Nyasaland, on 9th September. All who have been associated with him in the Quick Laboratory greatly deplore his loss.

Mr. K. R. Lewin, B.A. (my late assistant), Dr. E. Hindle (my assistant), and Mr. T. Storrar Cave (Helminthologist to the Quick Laboratory) have obtained commissions and are serving in the Army. Dr. Hindle's expedition to Africa was necessarily postponed owing to the war. Mr. E. S. Hay (Secretary) is serving as a trooper in the Loyal Suffolk Hussars, and Mr. B. G. Clarke (senior laboratory assistant) is serving as sergeant in the Royal Army Medical Corps Territorials. Mr. C. H. Harpley (junior laboratory assistant) was, prior to the outbreak of war, granted leave to proceed to Antigua to aid in the work of ankylostomiasis eradication.

Miss A. Porter, D.Sc. (London) resigned the post of Helminthologist upon her appointment to a Beit Memorial Research Fellowship, and was succeeded by Mr. T. Storrar Cave, B.A. (Corpus).

Mr. N. Cunliffe, B.A., resigned the studentship in Medical Entomology for a post in the Museum of Comparative Anatomy at Oxford. I have, with the consent of the Vice-Chancellor, appointed Mr. M. E. MacGregor, B.A. (Trinity), as his successor. Mr. MacGregor has recently held a Carnegie studentship under the Imperial Bureau of Entomology.

My staff is, therefore, temporarily reduced to Mr. C. Warburton, M.A. (Demonstrator in Medical Entomology), Mr. M. E. MacGregor, B.A. (student in Medical Entomology) and a laboratory boy.

Messrs. Warburton and MacGregor are at present actively engaged in research.

In addition to the members of the staff, we have had the following gentlemen carrying on research in the Laboratory during the year 1914:—Dr. Lajos Gózony, assistant in the Bacteriological Institute, Budapest (worked for five months); Dr. P. H. Ross, Government Veterinary Bacteriologist, Nairobi (worked for five months); Dr. J. O. Shircore, Medical Officer of Health, Nyasaland (worked for about four months). Mr. L. P. W. Renouf, B.A. (Trinity), pursued parasitological studies during the first half of the year, and Mr. L. Denton Sayers, B.A. (Downing) is now preparing himself to carry on research work in protozoology. Mr. L. Harrison, B.Sc., from Australia, has recently established himself in the Laboratory to pursue detailed studies upon the mellophaga and other parasites.

Dr. J. Y. Wood, Medical Officer, Kaballa, Sierra Leone, and Mr. F. J. MacCall, M.R.C.V.S., Veterinary Officer, British East Africa, both came, at the instance of the Colonial Office, to spend a week in the study of special subjects.

Miss Porter's work upon *Herpetomonas patellæ*, a parasite of the edible limpet, is of special interest as revealing such a flagellate for the first time in mollusca. She, in conjunction with Dr. Fantham, has made a remarkable observation showing that *Herpetomonas jaculum*, parasitic in *Nepa cinerea*, an aquatic insect, is pathogenic when introduced into mice. She is pursuing investigations upon the prevention of bee diseases and upon gapes in fowls.

Appendix III.

REPORT ON THE WORK OF THE QUICK LABORATORY AT CAMBRIDGE FOR THE YEAR 1914.

Drs. Hindle and Gózony have shown that Abderhalden's reaction may be of use in the study of protozoal diseases, and, together with Dr. P. H. Ross, they have obtained some interesting results by means of serological tests. They found (*a*) that precipitating antisera prepared by me in 1902 and since maintained in the dark at room-temperature in some instances still gave specific reactions, and (*b*) that complement fixation and precipitin reactions were obtainable with anti-fowl serum and the gut contents of *Argas persicus* and *Ornithodorus moubata* as long as twenty-three months after these ticks had fed upon fowls. Positive precipitin reactions, using anti-human serum, were obtained with the gut contents of *Pediculus vestimenti* up to three days after these insects had fed upon man.

Messrs. Hindle and Cunliffe report upon interesting experiments showing the remarkable power of regeneration of lost limbs possessed by *Argas persicus*. Mr. Cunliffe has shown by experiments upon *Rhipicephalus sanguineus* that the size and structure of the nymph and adult of this species is greatly influenced by the degree to which it is allowed to feed upon the host; he also gives the first description of the larva of *Argas brumpti*, a species which, in its maturer stages, has been found to attack man in Africa. Dr. Hindle records a curious malformation observed in *Acanthia lectularia*, and I have illustrated and described some remarkable monstrosities and malformations encountered in ticks. A paper of mine deals with the obscure affection known as "tick paralysis," of which further cases are cited as occurring in man in North Amercia and in sheep in South Africa; moreover, in a short note I record the first observation made in Great Britain of the penetration of *Txodes* beneath the skin, coupled with an explanation of the mechanism whereby penetration is effected.

It is largely due to the aid received from the Tropical Diseases Research Fund that we are able to carry on our work successfully. I trust, in view of the urgent need of men in the army, that the Advisory Committee will agree to my proposal to allow Dr. Hindle and Mr. Cave to receive their pay from the Fund during their term of military service, especially as the service they are performing is of paramount importance to the Empire.

GEO. H. F. NUTTALL,
Quick Professor of Biology in the University of Cambridge.

12th November, 1914.

List of Publications for the Year 1914.

1. Hindle, E., and Cunliffe, N. (I. 1914). "Regeneration in *Argas persicus*." (With 4 text-figures.) *Parasitology*, VI., 353-371.
2. Cunliffe, N. (I. 1914). "*Rhipicephalus sanguineus*: Variation in size and structure due to nutrition." (With 4 text-figures.) *Parasitology*, VI., 372-378.
3. Cunliffe, N. (I. 1914). "Observations on *Argas brumpti* Neumann, 1907. (With 1 text-figure.) *Parasitology*, VI., 379-381.
4. Nuttall, G. H. F. (V. 1914). "'Tick Paralysis' in Man and Animals. Further published records with comments." *Parasitology*, VII., 95-104.
5. Hindle, E., and Gózony, L. (XI. 1914). "Abderhalden's Reaction and its application to certain protozoal infections." *Parasitology*, VII., 228-239.
6. Nuttall, G. H. F. (XI. 1914). "Tick Abnormalities." (With 11 text-figures.) *Parasitology*, VII., 250-257.
7. Nuttall, G. H. F. (XI. 1914). "Penetration of *Ixodes* beneath the skin." *Parasitology*, VII., 258-259.
8. Hindle, E. (XI. 1914). "Note on a Leg Abnormality in *Acanthia lectularia*." (With 1 text-figure.) *Parasitology*, VII., 260-261.
9. Porter, A. (XI. 1914). "The morphology and biology of *Herpetomonas patellæ*, n. sp., parasitic in the limpet, *Patella vulgata*, together with remarks on the pathogenic significance of certain Flagellates found in Invertebrates." (With 17 text-figures.) *Parasitology*, VII., 322-329.
10. Gózony, L., Hindle, E., and Ross, P. H. (XI. 1914). "Serological Tests. 1. On the persistence of precipitins in sera stored in vitro; 2. On the reactions obtained with (*a*) complement fixation tests, and (*b*) precipitin tests, with the gut-contents of blood-sucking Arthropods." *Journal of Hygiene*, **XIV.**, 354-359.

APPENDIX IV.

Reports from the London School of Tropical Medicine for the year ended 31st October, 1914.

No. 1.

LONDON SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 14th May, 1914.)

Sir, Royal Albert Dock, E., 13th May, 1914.

I beg to submit herewith, for the information of the Advisory Committee of the Tropical Diseases Research Fund, the reports of the three Departments of Entomology, Helminthology, and Protozoology, for the half-year ended 30th April, 1914.

It will be observed that Dr. Leiper addresses his report from China. This is occasioned by the fact that he has been awarded the Wandsworth Scholarship, which, together with the grant of £250 made by your fund, has enabled him to undertake this expedition. He left England on the 20th February, accompanied by Surgeon E. L. Atkinson, R.N., who has been seconded by the Admiralty.

The report from Dr. Wenyon is the last that he will present, as he has resigned his appointment as Protozoologist in the School. Dr. Wenyon's resignation has been accepted with regret, and with an expression of appreciation of the work that he has done for the School. Arrangements are now being made for the appointment of a successor to him.

An assistant, in the person of Dr. F. W. O'Connor, has been provided for the Entomological Department, and the School purposes appointing assistants to the other Departments.

In order to make as complete as possible the arrangements for the examinations in the School, an Invigilator was engaged to supervise the School examinations at the end of the last session, and this method will be adopted on all future occasions. The School is indebted to Mr. G. K. Paley, of the Civil Service Commission, for assistance in this matter.

At the end of the year Mr. Austen Chamberlain closed his fund. The total amount received, with interest, during the time the appeal was in progress, is £73,475, which has been allotted as shown in my last communication.*

I enclose herewith a statement of the School accounts† for the year ending 31st December last. It will be seen that the form is materially altered so as to bring the accounts into line with the method adopted by the Board of Education. The accounts submitted show no income from Mr. Chamberlain's Fund, for the reason above stated.

I am, &c.,
P. MICHELLI,
Secretary.

Enclosure 1 in No. 1.

Report of the Entomologist for the Half-Year ending 30th April, 1914.

The activities of the Entomological Department during this period have been directed almost entirely towards maintaining and perfecting the arrangements for teaching, this limitation of outlook being inevitable so long as the official courses of instruction are so frequent and the classes so large as they now are. Such a limitation, however, is not entirely a matter for regret, since one of the most useful services to tropical medicine and hygiene that the entomologist stationed at home can render is educational.

In the teaching the chief novel feature is that more attention is being directed to the study of living insects in the new insect house.

Four courses of lectures and demonstrations in medical entomology, and two dealing with snakes and their venoms have been conducted.

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* See page 91 of [Cd. 7261.] † Not reprinted.

Appendix IV.

REPORTS FROM THE LONDON SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31ST OCTOBER, 1914.

In the insect house the life history of the bed bug, of certain ticks and mites, and of *Anopheles bifurcatus*, and several aquatic insects found in association with its larva, have been under observation. Among the mites particular attention was paid to the viviparous parasitic species, *Pediculoides ventricosus*.

The *Pediculoides* was brought to our notice through the authorities of the Port, in consequence of an outbreak of an exceedingly irritant form of skin eruption among labourers engaged in unloading cotton seed. Samples of the seed were brought to the School, and were found to be infested with caterpillars of the moth *Gelechia gossypiella*, Durrant, the "boll-worm" caterpillar, so destructive to growing cotton in Egypt. The caterpillars in turn were found to be grossly infected with the mites *Pediculoides ventricosus*, and it was these that had so freely attacked the labourers who had handled the seed. The caterpillars were bred out for identification in the insect house, and the whole life history of their interesting parasite was observed and recorded, and plenty of material in all stages was preserved. It was noticed that caterpillars attacked by several mites at once were always killed, but that while the caterpillars were concealed in the seed the mites could not get at them. The "medical" aspects of the case were carefully studied by my assistant, Dr. F. W. O'Connor, who has prepared a report on this unusual—though not novel—matter, which, at the time, had a most disconcerting effect, not only upon the victims of the attack, but also upon their immediate employers and upon the consignees of the cotton seed.

The Entomological Department has kept in touch with numerous interested correspondents in many parts of the world, by whose kind attentions the museum and the reserve and study collections have been much enriched. The following donors deserve particular notice:—

The Imperial Bureau of Entomology: a large collection of well-preserved and authentically-named blood-sucking flies.

Professor R. T. Hewlett: a multitude of *Anopheles maculipennis* and *bifurcatus*.

The Hon. Charles Rothschild: specimens of *Pygiopsylla*, a flea which has been shown by experiment in Java to be capable of harbouring the plague bacillus.

Assistant-Surgeon C. R. Avari: beautiful specimens of various snake venoms, and photographs of living venomous snakes, from India.

Dr. P. H. Bahr: a very fine collection of mosquitoes and snakes from Ceylon

Major A. B. Fry, I.M.S.: a select series of *Culicidæ* from Bengal.

Captain C. A. Gill, I.M.S.: an inexhaustible box of divers species of *Anopheles* from Northern India.

Captain G. G. Jolly, I.M.S.: some venomous snakes from Baluchistan, including *Pseudocerastes persicus*.

Dr. P. J. Kelly: venomous snakes from South China.

Major C. Lane, I.M.S.: bot worms and other parasitic muscoid larvæ from India.

Dr. A. R. Neligan: several species of ticks—some living—from Persia.

Dr. R. Roper: *Anopheles* mosquitoes from North Borneo, including great store of *A. umbrosus*, which he has discovered to be one of the local malaria carriers.

Dr. G. C. H. Davies: a venomous fish (*Pelor didactylum*) from the Solomon Islands, with notes of a case of injury inflicted by it.

Dr. D. Burrows, Dr. Graham Cobb, Dr. W. B. Johnson, and Dr. C. E. S. Watson: each and severally common mosquitoes and other blood-sucking flies of Nigeria.

Dr. W. E. Glover: numerous insects and venomous snakes from Nigeria.

Dr. J. C. L. Johnstone: scorpions from Nigeria.

Dr. J. Pollard: specimens of the larva of a tiger beetle from Nigeria. These larvæ, according to Dr. Pollard's own observation, inflict a bite which is almost as serious as the sting of a scorpion.

Dr. Minnett: flies from British Guiana.

Dr. R. U. Moffatt: numerous mosquitoes from the Amazon country, also specimens of a Staphylinid beetle, *Pæderus amazonicus*, Sharp, that exudes an actively vesicant secretion

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Dr. J. M. O'Brien: a large Belostomatid bug from South America.

Dr. H. G. F. Spurrell: another large collection of noxious insects, and some venomous snakes from Columbia.

A. Alcock,
Lieut.-Col. I.M.S. (retired list).

London School of Tropical Medicine,
27th April, 1914.

Enclosure 2 in No. 1.

Report of the Helminthologist for Half-Year Ending 30th April, 1914.

Sir,

Soochow, China, 10th April, 1914.

I have the honour to submit my report as Helminthologist to the London School of Tropical Medicine for the half-year ending 1st May, 1914.

The various papers referred to as at press, or in preparation, in my last report have now been published. Four additional contributions have been published during the period under review.

(a) *Seven Helminthological Notes*:—In the Journal of the London School of Tropical Medicine.

(b) *Parasites of Domesticated Animals which Infect Man*:—In the Veterinary Record and Veterinary News.

(c) *The Helminthes Collected by the National Antarctic Expedition*, 1910-1912 (Jointly with Surgeon Atkinson):—In the Proceedings of the Zoological Society of London.

(d) *Materials for a Bibliography of the Trematode Infections of Man*:—(Jointly with Miss V. A. Inglis), published separately.

Instruction.

The usual courses of medical and veterinary helminthology were given, but it has been decided to discontinue the latter course. In future, lectures on helminthology will also be given in the course on tropical sanitation and hygiene.

The helminthological laboratory has been utilized for research by two workers during the three months from October to December.

Captain Shortt, I.M.S., devoted attention to certain new nematodes, partly collected by himself in India, and partly derived from the Zoological Gardens in London. I regret that owing to my absence abroad I have had to resign the work of reporting upon the worms collected at the Zoological Gardens. Surgeon Atkinson, R.N., parasitologist to the Scott Antarctic expedition, has worked constantly in the laboratory upon the large collection of worms made by him in the south, and, with me, has written for the scientific results of the expedition a detailed report upon the helminthes. A preliminary note establishing a large number of new species and several new genera has already been published by us in the proceedings of the Zoological Society of London.

With funds provided partly by the Tropical Diseases Research Committee of the Colonial Office and partly by the London School of Tropical Medicine I was afforded the opportunity of undertaking further research work in the field, and early in February proceeded to China for the purpose of studying the mode of spread of trematode infections of man, especially bilharziasis.

In view of the importance of Asiatic schistosomiasis to the Navy, it was thought that the Admiralty might assist in these investigations, and they were pleased to second Surgeon Atkinson, R.N., for the work.

The party reached Shanghai on 30th March, 1914, with the intention of working in the Yangtsze Valley in the first instance. The local authorities of Shanghai have shown much practical interest in the proposed researches, especially Mr. Pearce, the Chairman of the Municipal Council, Mr. Leveson, the Secretary, and Dr. Stanley, the Medical Officer of Health. Mr. Cleor, the General Manager of the Shanghai-Nanking Railway, and Dr. Ziervogel, the Chief Medical Officer, have given us many facilities.

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During the fortnight that has now elapsed since our arrival, we have obtained a houseboat and equipped her as a floating laboratory, so that we can proceed through the agricultural regions by water. Dr. Stanley has placed a room at our disposal in the Municipal Health Department, so that for the present we intend to utilize Shanghai as our base, returning there periodically and when necessary with material for more careful investigation and for supplies. Later, it will probably be advisable to go higher up the Yangtsze River to compare the fauna, but our immediate plan is to ascertain a heavily infected village in what we have already determined to be an endemic area extending to within fifteen miles of Shanghai City.

I have, &c.,

Robert T. Leiper.

Enclosure 3 in No. 1.

Report of the Protozoologist for the Half-Year Ending 30th April, 1914.

During the period covered by this report the usual classes in general and advanced protozoology have been conducted.

Research work has been chiefly concerned with investigations on leishmaniasis. It has already been frequently pointed out that the kala-azar of India differs from that of the Mediterranean districts in that in India (Madras and Calcutta) the disease seems to be limited to human beings, whereas in the Mediterranean centres dogs also are liable to be infected. Search in the Indian centres for naturally infected dogs has always been negative, so that some have been led to conclude that this constitutes a specific difference between the two parasites. The Mediterranean disease is inoculable experimentally from children to dogs, and one naturally wondered whether this was true also of the Indian form. Quite recently Donovan and Patton have succeeded in infecting Indian dogs by injecting large doses of virus obtained from human cases. I have been able to test the result of the inoculation of English dogs with the virus of Indian kala-azar, my material having been obtained from an Indian case which died in the Albert Dock Hospital.

The spleen of the case, which was very heavily infected, was broken up in about an equal volume of saline solution, and the resulting emulsion injected into the dogs intraperitoneally, this having been shown to be the most successful method with the Mediterranean virus.

(A.) Four healthy dogs were thus inoculated with five c.cm. of this emulsion, which, as already stated, contained enormous numbers of parasites.

Dog 1. Inoculated 22nd September, 1913. This dog remained well till 10th October. It became worse and was killed on 12th October. Fair numbers of leishmania were found in the liver, spleen, and bone marrow. Apart from the leishmania there was no apparent cause of illness.

Dog 2. Inoculated 22nd September, 1913. This dog remained in good health. A liver puncture performed on 20th October showed one typical leishmania in a large cell. On 20th January, 1914, a bone marrow examination was made, when fairly numerous leishmania were found. This was again done on 16th April, 1914, but no parasites could be discovered. During the whole of this time the dog has remained in perfect health, and has grown even more quickly than a control of the same litter kept with it in the same run.

Dog 3. Inoculated 22nd September, 1913. This dog had previously (26th March, 1913), been inoculated intravenously with 4 c.cm. of cultures of varying ages of *Leishmania donovani* (Bombay strain obtained from Dr. Row). No infection resulted. Six months later it was inoculated (22nd September) from the case of kala-azar. On 19th November a liver puncture was negative. On 16th December the dog did not appear well—liver puncture again negative. On 16th January, 1914, bone marrow examination revealed numerous leishmania. The dog was developing a mangy condition of the head, a feature very common in the natural canine kala-azar of the Mediterranean districts. 5th April, another bone marrow examination again revealed numerous leishmania. The dog is still under observation.

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It is interesting to note that the previous inoculation of cultures did not either infect the dog nor did it protect against subsequent inoculation of virus.

Dog 4. Inoculated 22nd September, 1913. This dog had also previously received an intravenous injection of 4 c.cm. of culture, as in the case of dog 3, on 26th March, 1913. No infection resulted. The inoculation of the virus on 22nd September also has produced no detectable infection, though repeated examinations of the marrow have been made. Dogs 3 and 4 belonged to the same litter and were of approximately the same size.

(B.) *Dog* 5. This dog between 1st March and 23rd June, 1912, had a mild attack of piroplasmosis, resulting from an infection by ticks collected in Aleppo in September, 1911. The ticks were fed on the dog on 1st March, 1912.

On 26th July, 1912, the dog was inoculated in each ear from sores on the ear of another dog which had been infected from a case of South American dermal leishmaniasis (*Leishmania tropica*).

During August and September, 1912, the dog developed sores on the ears at the points of inoculation. During the course of the next few months the sores which had contained large numbers of leishmania completely disappeared. On 22nd September, 1913, the dog was inoculated with 20 c.c. of the spleen emulsion from the case of kala-azar by way of testing whether the previous infection with *Leishmania tropica* of oriental sore would protect against *Leishmania donovani* of kala-azar. This dog did not become infected. It was killed on 16th January, 1914, and a careful examination of the organs by smears and culture methods gave only negative results.

From these experiments it results :—

1. That English dogs may be infected with the virus (*Leishmania donovani*) of Indian kala-azar.

2. The previous failure of injection of cultures to infect does not protect against a subsequent inoculation of virus.

3. A dog recovered from a previous attack of oriental sore did not become infected with kala-azar virus, though the dose given was four times as great as that which infected other dogs. It must be remembered, however, that one dog (dog 4) did not become infected with *Leishmania donovani*, though it had had no previous infection with *Leishmania tropica* of oriental sore.

4. From these experiments on dogs there appears to be no reason to regard the Indian and Mediterranean diseases as distinct.

One cat was inoculated intraperitoneally with the spleen virus, but no infection resulted.

Five rats were similarly injected. In one of these liver puncture performed three weeks later showed a few leishmania. The others were killed later, but were not infected.

The culture of leishmania from the finger blood of a case of kala-azar.

On a case of kala-azar which was in the Albert Dock Hospital, under the care of Dr. Sandwith, I was able to test the possibility of culturing leishmania from the peripheral blood. Six tubes of N.N.N. medium were inoculated each with two or three drops of blood obtained by pricking the finger of the patient. Eighteen days later there was a culture of flagellates in each of five of the tubes which were not contaminated with bacteria. The culture method may thus be employed as a means of diagnosis in this disease and it is a method which is not so distasteful to the patient as either spleen or liver puncture. A paper on this subject was published in the Journal of Tropical Medicine and Hygiene for 16th February, 1914.

On 19th December, 1913, I read a paper before the Society of Tropical Medicine and Hygiene on the subject of kala-azar in Malta with some remarks on the various Leishmaniasis. This was published in the "Transactions of the Society." The main points of this paper were based on observations I made in Malta during last summer and have already been mentioned in my last half-yearly report.

A good deal of my time has been occupied in the examination of material from the hospital and in reporting on other material which has been received from abroad.

C. M. Wenyon

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REPORTS FROM THE LONDON SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31ST OCTOBER, 1914.

No. 2.

LONDON SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 31st October, 1914.)

London School of Tropical Medicine (University of London),
Royal Albert Dock, E., 30th October, 1914.

Sir,

The reports of the Special Departments of the London School of Tropical Medicine are now due and I have the honour to submit herewith Colonel A. Alcock's report in regard to entomology for six months and Dr. C. M. Wenyon's report in regard to protozoology for the three months ended 31st July. There is no report from Dr. R. T. Leiper, the Helminthologist.

Dr. Wenyon has resigned his post as Protozoologist as from the 31st of July and he is now no longer in the service of the School. He is succeeded by J. Gordon Thomson, M.B., Ch.B., formerly of the Liverpool School of Tropical Medicine and of the Royal Society of Medicine. Dr. Thomson took up his duties at the School on the 21st of September, and his report for the ensuing six months will be made in due course.

Dr. Leiper, the Helminthologist, as stated in my last communication, has been in China and Japan in connexion with an inquiry into the mode of spread of trematode infections of man, especially bilharziasis, and the relation of these diseases in man to those in domesticated animals. Dr. Leiper had to curtail his stay on account of the outbreak of war and has only just returned to England. The position of some of his investigations is scarcely sufficiently far advanced for him to make a formal report at the moment in regard to the subject of his mission to the East. His report for the whole of the period during which he was absent will be submitted at the end of the ensuing six months.

Surgeon E. L. Atkinson, R.N., who accompanied Dr. Leiper, left China on the announcement of the outbreak of war, and arrived in England on the 31st August.

Up to the end of the summer session the work in the school was carried on uninterruptedly. During the academic year commencing 1st October the total number of students attending was 168, as follows :—

October—December, 1913	71
January—April, 1914	40
May—July, 1914	57
	168

In consequence of the war the number of students who have entered for the present session, which commenced on the 1st of October, is only 15.

Furthermore, it has been found necessary to abandon the course in Tropical Sanitation and Hygiene as Dr. B. H. Wedd, the Bacteriologist and Demonstrator, has been called up for active service.

It will be observed in Colonel Alcock's report that his Assistant, Dr. F. W. O'Connor, has also been called up for service, and thus the Entomological Department is now without an Assistant.

I am, &c.,
P. MICHELLI,
Secretary.

Enclosure 1 in No. 2.

Report of the Entomologist for Half-year ending 31st October, 1914.

London School of Tropical Medicine, Royal Albert Dock, E.

Since the beginning of August the Department has suffered a check, just as it was beginning to expand in a new direction, by the departure for the war of the Assistant, Dr. F. W. O'Connor, and the Laboratory Assistant, W. McDonald. Their places are being kept open, but it will be very difficult to obtain trained substitutes for temporary service, and without experienced assistants who can give continuous attention to the matter it will be impossible to carry on the vivarium.

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During the period in report the usual school courses of instruction in medical entomology and snake toxicology, and a special course of entomology for officers deputed by the Colonial Office, have been conducted. The entomological demonstrations included living insects pertinent to medicine—among them larvæ of *Stegomyia fasciata* which were hatched here from eggs sent from West Africa by Mrs. Connal, who formerly, as Miss Summers, worked in this laboratory.

The life-history of several common insects of pathogenic importance has been followed out in the vivarium in confirmation of recorded observations, and a good deal of material required for class work has thus been secured in all stages of development.

In the summer recess an expedition visited Lough Mask, in the west of Ireland, to observe some of the blood-sucking flies—in particular *Chrysops relicta*—which are so abundant there. The observations were interrupted, by events arising from the outbreak of war, at a most promising stage, but strong presumptive evidence was obtained that *Chrysops relicta* pairs and oviposits in sheltered situations having well-defined natural features, of which propinquity to water is by no means the only one, and sufficient living material was brought away to give hope of settling the question. In any case observations were recorded exact enough to enable the inquiry to be resumed at the proper moment without loss of time.

In the summer session Dr. Richard Roper, an old student of the school, worked out a collection of Anopheles mosquitoes which he had brought back from North Borneo. His results, which are an important contribution, on the entomological side, to the sanitation of an almost unstudied British settlement, have been published in the *Bulletin of Entomological Research.*

The inquiries of numerous correspondents have been attended to. Among interesting items of this correspondence the following deserve mention :—

From the Bombay Presidency Dr. J. F. D'Mello sent a lot of living *Ornithodorus savignyi*, with an account of their habits as pests in market-places and cattle stands. Among them were some small crab-spiders having a remarkable resemblance in form, colour, pose, and movements to the ticks themselves.

From Berar Major J. S. Oxley, I.M.S., sent a number of Cecidomyid larvæ and pupæ which were said to have been removed from the eyes of patients by a quack doctor.

From Assam Dr. F. C. McCombie sent some Mycetophilid flies—a species of Sciara—which are said to bite.

From Assam also Dr. R. Murphy sent an entomological collection that had been passed alive by one of his patients : it included a caterpillar of a flour moth, a small adult mealworm bettle (*Tribolium ferruginium*) and a number of larvæ and pupæ of a moth-midge.

From Travancore Major Clayton Lane. I.M.S., sent some larvæ of a large Carabid beetle taken from the gut of an elephant, and some extraordinary larvæ, probably of a large Anthomyid fly, passed by another elephant.

From North Borneo Dr. E. L. Mansel sent a specimen of *Chrysops fixissima* with an account of the effects of its bite upon a strong healthy European planter. The bite was not painful at the moment, but caused enormous local swelling, so that an "arm became like a leg," and an "ear like a cauliflower," and eventually gave rise to "nausea, malaise, and general prostration," lasting for forty-eight hours. The fly is "well known to the natives of the district, who call it *pikat.*"

From Northern Nigeria Captain H. D. Foulkes sent a number of *Ornithodorus savignyi* with a long and interesting account of its habits and local occurrence. Captain Foulkes states this tick in Northern Nigeria is found only in sandy districts in the vicinity of Lake Chad, and there chiefly on the sites of old-established markets, and that the natives, who know it as *Girgidi*, "fear its bite as much as they do guinea worm."

The museum of the Department, which is strictly a "practical" one, has continued to increase. Among the many friends who have contributed to it, and to the departmental library which is associated with it, the following have to be mentioned with due acknowledgments :—His Majesty's Secretaries of State for the Colonies and for India, the Imperial Bureau of Entomology, the Tropical Diseases Bureau,

the Indian Research Fund Association, Dr. D. Burrows, Mrs. A. Connal, Dr. Drummond, of Nyasaland, Dr. W. A. Lamborn, Dr. D. T. Mitchell, Dr. J. S. Pearson, Dr. G. Rollason, Dr. R. Roper, Dr. G. H. F. Spurrell, Dr. A. T. Stanton, Dr. R. Y. Stones, Dr. G. V. Sturgess, Dr. P. H. Bahr, Dr. C. W. Daniels, Dr. F. W. O'Connor, and Dr. F. M. Sandwith.

October, 1914. A. ALCOCK.

REPORT OF THE PROTOZOOLOGIST FOR THE THREE MONTHS ENDED 31ST JULY, 1914.

THE last report submitted by me covered the six months ending 30th April, 1914. This report covers only the succeeding three months, owing to my having resigned from the post of Protozoologist at the London School of Tropical Medicine in July. During this period I carried out the regular duties of the Protozoologist in conducting the protozoological section of the general course and in giving instruction to two students in the advanced course.

In the way of research work my experiments on leishmania were continued, and I have shown that it is possible to transmit the human parasite in India *Leishmania donovani* to dogs and to carry on the strain a certain number of passages.

The possibility of doing this is of the greatest importance in experimental work on the transmission of kala-azar by means of insects, for until the disease can be reproduced with certainty in animals it will be impossible to test the transmitting power of various insects.

Another line of investigation has been an inquiry into the possibility of conferring immunity on an animal against kala-azar by a previous infection of the much milder and local disease of oriental sore. As far as my results go they are not at variance with the view that oriental sore will confer immunity against kala-azar. These investigations have not yet been completed but they will form the subject of a future publication.

The importance of the claims made by Dr. Harald Seidelin that he had succeeded in inoculating the virus of yellow fever into guinea-pigs, and that in these animals he could detect in the red corpuscles the piroplasma-like bodies claimed by him to be the cause of the disease, led Dr. G. C. Low and me to examine the blood of healthy guinea-pigs for similar bodies. As a result of these investigations we found that bodies did occur in the red blood corpuscles of these animals and that it was extremely difficult to distinguish such from those claimed by Dr. Seidelin to be parasites of yellow fever. These observations, again, were not completed when I left the London School of Tropical Medicine, but they have been continued elsewhere. It is hoped to publish a paper on the results very shortly.

On the subject of trypanosomiasis an investigation was made of several cases of human disease under treatment in the Albert Dock Hospital. In three of these it was found by inoculation into rats that the trypanosomes were of the Rhodesian type and were *Trypanosoma rhodesiense*. In two other cases from Nigeria it was found possible to produce a mild infection in one rat from one of these. The trypanosomes behaved as *Trypanosoma gambiense* and were probably of this nature. These cases illustrate very well the difference in virulence of the two human African trypanosomes. The rats inoculated from the Nigerian cases either did not become infected or acquired a mild infection from which they recovered. Those inoculated with the Rhodesian forms invariably had an intense infection which terminated fatally.

October, 1914. C. M. WENYON.

No. 3.

LONDON SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 15th January, 1915.)

Helminthological Department,
London School of Tropical Medicine, E.,
1st January, 1915.

SIR,

IN the last half-yearly report presented by me, in April, 1914,* brief reference was made to my arrival in Shanghai and the commencement, under exceedingly favourable auspices, of investigations upon trematode infections of man.

* Enclosure 2 in No. 1.

Appendix IV.

REPORTS FROM THE LONDON SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31st OCTOBER, 1914.

This long-projected expedition had been rendered feasible by a special grant from the Tropical Diseases Research Fund of the Colonial Office, which was supplemented by certain funds at the disposal of the Committee of the London School of Tropical Medicine. The Admiralty also assisted, in view of the importance of the subject to the Navy in the Far East, by seconding Surgeon E. L. Atkinson, R.N., to accompany me.

It was anticipated that the full programme of the expedition would occupy about a year, but the outbreak of war at the beginning of August necessitated its curtailment. Surgeon Atkinson left at once via Canada to rejoin the Fleet. Failing to obtain official instructions, and in view of local conditions, I also decided to return, but, as our experiments were at a most interesting and critical stage, I remained for a further period of three weeks in order to ensure that at least the primary object of our work should be fully secured. I then proceeded home via Suez, breaking my journey at Colombo and Port Said to canvass the possibilities of resuming work in Rhodesia, Egypt, or Cyprus. The difficulties, financial and other, proved everywhere insurmountable to a civilian at that time. After an absence of eight months, I reached London towards the end of October.

Outline of Programme of the Wandsworth Expedition.

Two ideas underlie the general plan of campaign projected and actually followed. (1) A laboratory base was to be established in a large European centre within a few days' access by rail or water of the great endemic areas of the trematode infections of man in Asia. (2) The occurrence of the various infections of man in domesticated animals, especially dogs, rendered the work independent of hospitals and native patients.

Shanghai was chosen and proved ideal as a centre, being within easy reach by rail and river boat of endemic areas of schistosomiasis around Kashing, on the Yangtse, as far as Hankow: and, by ocean steamer, of the infected areas of Japan. Paragonomiasis in North Formosa and in Korea could also be reached by steamer in forty-eight hours. Clonorchis and yokogawa proved to be endemic in and around Shanghai itself. Fasciolopsis was found sporadic within two hours by train, while the endemic centre of Shaohsing could be reached in less than two days. Shanghai possesses, moreover, a highly efficient Public Health Department and well-equipped Municipal Laboratories, in which, through the kindness of Dr. Stanley, the Principal Medical Officer of Health, every facility and assistance was enjoyed. Moreover the daily operation of the stringent regulations of the municipality provided large numbers of dogs at short notice for our work. It became then only necessary to secure dogs heavily and naturally infected with the various trematode diseases, and to bring into the central laboratory, for experimental work, the various molluscs and other possible intermediaries inhabiting the different endemic areas. These latter were obtained from various districts within 500 miles of Shanghai, mostly by working from a house-boat upon the canals which intersect this region.

The other investigations were intended to be subsidiary to the elucidation of the exact life history of the *Schistosoma japonicum*, but, owing to our failure to obtain from any source a suitable case of schistosomiasis until the end of June, our work on the other infections was more frequently interrupted than we had allowed for in our time-table. The partial results obtained from these, however, may be briefly summarized here:—

Summary of Results.

(*a*) The following helminths, which occur as parasites of man, were found in dogs collected by the police from the Shanghai municipal area:—*Clonorchis sinensis*, *Yokogawa yokogawai*, and *Dibothriocephalus latus*. A species of Echinosome, a new Metorchis, *Dirofilaria immitis*, and the common *Ankylostoma caninum* were collected also.

(*b*) We were unable to establish the complete life history of Clonorchis, but it is noteworthy that no species of trout (which has been shown to be the carrier in Japan) occurs round Shanghai. Houghton has claimed to have found a free-moving

cercaria on the mucous membrane of the gut of a certain fish from the river Yangtse. We have found a similar body to this, but are convinced that it has nothing to do with the life cycle of Clonorchis. A study of the morphology of these canine Clonorchis throws some light upon the question of duality of species.

(*c*) *Yokogawa yokogawai* occurred in a large number of the dogs in Shanghai. This parasite has not heretofore been noted as occurring in China. We found in a kind of perch (not yet named) encysted cercariæ, which further work will probably prove to be the larval form of this parasite. The eggs resemble closely those of Clonorchis, and it may be that records of the discovery of Clonorchis eggs in fæces in human cases in Shanghai may be to some degree inaccurate.

(*d*) *Dibothriocephalus latus* was found in one dog, and the eggs were isolated and set aside to hatch for experimental work. The text-books state that even in warm weather a month is required for the proper formation of the embryo. These eggs hatched quite unexpectedly within a fortnight, when we were not thus early prepared to follow their further course. It is a remarkable thing that, although the infection of man and dogs with this form has been repeatedly carried out in feeding experiments with infected fish, no one has yet succeeded in ascertaining whether the fish are directly infected or secondarily through another intermediate host.

(*e*) The Shanghai dogs were also heavily infected with a species of Echinostome belonging to the genus Echinochasma. We succeeded in recognizing the larvæ of this form in a freshwater fish, not yet named, common in the markets of Shanghai, and in experimentally infecting a dog by feeding. This form may prove of further interest, for the egg resembles very closely that of *Fasciolopsis buski*, and it would be not at all surprising to find it as a human parasite of man in China.

(*f*) A new Metorchis, obtained from the bile ducts of a dog, is of interest as possibly throwing light upon the reputed *Metorchis truncatus* reported from man in Siberia. This form resembles, when stained, *Opisthorchis sibericum* much more closely than does *Metorchis truncatus.* It is small, the skin is covered with spines, the testes are tandem and deeply lobed.

(*g*) *Dirofilaria immitis* in Shanghai, as in other parts of China, is very common in dogs, but, as its life history has already been traced, it did not seem advisable to devote time to this form.

(*h*) *Ankylostoma caninum*, the common hook-worm of the dog, occurs in practically every dog examined. We found no other species. This is notable, in view of the statement in Jeffrey's and Maxwell's "Diseases of China," that *Ankylostoma duodenale* of man occurs also in dogs in Shanghai. The ankylostomes reported there as occurring in snakes are a species of *Kalicephalus*, while those from chickens may be *Heterakis vesicularis,* also found by us.

(*i*) In the public abattoirs we devoted some attention to the parasites of pigs. *Trichinella spiralis* would appear to be very rare in Shanghai if it occurs.* We did not come across or learn of a single case. The pigs were remarkably free from parasites. The pigs in the south of China are often infested with a species of Fasciolopsis. We received specimens in cold storage from Hong Kong and were able to compare the anatomy with that of typical Fasciolopsis from Shaohsing. All specimens show the same morphology. Differences which have given rise to various specific designations are easily produced by various manipulations. It is especially notable that all specimens, both from pig and man, have spines on the skin in the living state.

The larval stage of Fasciolopsis is said to encyst in freshwater shrimps. We found these cysts, but attempts to infect pigs were unsuccessful.

(*j*) The occurrence of a very good case of ankylostomiasis at Hangchow enabled us to test the practicability of employing chemical manures to destroy ankylostomes in fæces without impairing the organic manurial value. All the commonly used chemical manures were tried, and with one we obtained highly suggestive results. The method must be repeated in a larger series of laboratory

* It occurs in a considerable percentage of the pigs in Amoy.—P.M.

experiments, but if these prove equally effective our work may point to a simplification of the nightsoil problem in tropical communities, converting a loss into profit.

(*k*) At Hankow Dr. Atkinson noticed in a species of *Lymnœus* an encysted form, which I diagnosed as an encysted cestode near to *Echinocotyle*, and probably a parasite of ducks. We succeeded in infecting a duck by feeding it on these infected snails, and later obtained the adult tapeworms, which confirmed our preliminary diagnosis. Usually these tapeworms encyst in crustacea.

Results of Schistosome Experiments.

None of the dogs examined in Shanghai were infected with *Schistosoma japonicum*, and our inability to obtain suitably infected dogs greatly embarrassed and delayed our work, in spite of the efforts of many friends. A number of sportsmen from as far up the Yangtse River as Hankow kindly sent dogs to us for examination. Several of these showed signs of old infections but were useless for experimental work. All the cases seen in man were of similar type. It was necessary to obtain an animal passing practically nothing but blood and mucus full of eggs, in order that the eggs might be quickly isolated by dilution with water before they hatched.

In the latter half of June, Surgeon Atkinson and I visited Hankow, 500 miles up the Yangtse. A large number of dogs were examined there, but only on the last day of our visit did we succeed in obtaining one which proved ideal for our purpose, and with this, on loan, we then returned to Shanghai. During the whole period of waiting we had made extensive collections and dissections of all the molluscs in the areas visited, so as to become acquainted with the various larval trematodes with which these are naturally infected. Attempts were made to infect mice and rats with the cercarial forms found. The infected dog now gave us a large amount of material with which to carry out a further biological test on the various molluscs. As the special species of mollusc which acts as the proper intermediary for a trematode has a definite chemiotaxis for the newly hatched trematode embryo we endeavoured to establish such a chemiotaxis for the embryo of *Schistosoma japonicum.*

While these experiments were proceeding I took occasion to visit Katayama, an agricultural district in Japan, which has given its name to Schistosome disease on account of the intensity of infection in that area. I collected the various molluscs from the rice fields and took them back to Shanghai. There were various species of Vivipara, and innumerable samples of a small, exceedingly common, conical form, to the naked eye apparently identical with that already implicated by Miyairi, in Kiu Shu, as the intermediary, and said to be a species of *Lymnœus.* As it had, however, an operculum and more than seven spirals, this small form has been submitted to Mr. Robson, the expert on mollusca at the British Museum, who has sent me a detailed description, and informs me that it belongs to a new genus and new species in the family Hydrobiidæ, for which we propose the name *Katayama nosophora.*

Living specimens of this small form were examined in Shanghai and revealed the following points :—

(*a*) They presented a marked attraction for the miracidia of *Schistosoma japonicum.*

(*b*) The liver frequently contained cercariæ which presented a morphological character of such significance as to establish at once a presumption that they belonged to the peculiar genus Schistosoma, viz., the absence of a pharynx. Although searched for, this character was lacking in all the cercariæ hitherto found by us. In other respects the cercaria resembled a small group of known forms provided with a bifid tail, but with a pharynx. The cercaria was provided with very minute spines and, except for the absence of pharynx, presented all the characters usual in a trematode cercaria. The bifid tail enabled it to progress in a very unusual and striking manner. On a solid surface the oral and ventral suckers were used for progression in "louping" fashion; but, when the cercaria desired to swim freely, it proceeded backwards, the two prongs and stem of the tail vibrating so as to draw along the body behind. In fact, the progress was like

that of an aeroplane with the propeller in front, whereas, in other cercaria with the ordinary simple tail the movement is like that of a ship with the propeller behind.

There is no stylet or chitinous armature in the mouth, but there is a large hollow oral sucker and large secreting glands. The ventral sucker is small but exceedingly muscular, the lumen being a triradiate slit.

(*c*) These cercariæ were contained in very long and slender filamentous sacs which sometimes showed a small non-muscular knob at one end: these sacs certainly are sporocysts in which the cercariæ develop directly without intervention of Rediæ. According to Kumagawa the form described by Miyairi is said to have two generations of Rediæ.

(*d*) Cercariæ of this type were removed from the livers of a number of the infected molluscs into water and allowed to become free-swimming. Young mice, bred in the laboratory at Shanghai and reared upon dry rice and water, were then partly immersed. No fluid was allowed to reach the mouth.

At this stage, convinced (1) by the biological test and (2) by the morphological peculiarity of the cercaria that the mice would probably show infection, I then decided to turn homewards.

Owing to exceedingly rough and inclement weather, some of the mice died within the first few days of our departure. They had to be left in charge of an Indian butcher on the ship, as a lady passenger in a neighbouring cabin early objected to my "pied piper" companions. After a lapse of three weeks, I was able by dissection, under rather difficult circumstances on board ship, to obtain Schistosome worms. Within a few days after my return to England the dissection of the last surviving mouse was made in the laboratories of the London School of Tropical Medicine in the presence of Dr. Sandwith and Dr. Hänschell. Living Schistosome, male and female, worms were then demonstrated in numbers in the mesenteric vessels.

These experiments, carried out with the greatest precautions to avoid fallacy, convince me that the Looss hypothesis (which for so long has dominated scientific opinion, and which supposes that infection takes place by direct contamination with newly hatched embryos without the intervention of an invertebrate host) is entirely erroneous, and that prophylactic measures based thereon would be wholely inefficient. The life cycle of the *Schistosoma japonicum* conforms in essential respects with that of other trematodes. It remains now to be demonstrated that *Schistosoma hœmatobium*, the cause of bilharzia disease, follows a similar course.

Since my return, the War Office has asked the School Committee for my services and is affording me an opportunity of studying the mode of spread of bilharzia disease in Egypt, especially with a view to advising measures for the prevention of the spread of this disease among troops engaged in military operations in the Nile delta.

This cursory report of the joint work of Surgeon Atkinson and myself has been prepared hurriedly within a few days of my leaving again for the tropics. Many details of the work have still to be related. I have also to defer to a later date acknowledgment of the various kindnesses and assistance afforded to members of the expedition during their stay in China and Japan.

I have, &c.,

ROBERT THOMSON LEIPER.

APPENDIX V.

Reports from the Liverpool School of Tropical Medicine for the year ended 31st October, 1914.

No. 1.

LIVERPOOL SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 1st May, 1914.)

SIR, B10, Exchange Buildings, Liverpool, 30th April, 1914.

I HAVE the honour to enclose, for the information of the Tropical Diseases Advisory Committee, the following reports of the Liverpool School of Tropical Medicine for the six months ending 30th April, on the work done in connexion with the Government grant, *viz.* :—

(1) Report of the Professor of Tropical Medicine. (Professor J. W. W. Stephens.)
(2) Report of the Professor of Medical Entomology. (Professor Robert Newstead.)
(3) Report of the Lecturer in Parasitology. (Dr. H. B. Fantham.)
(4) Report of the Director of the Runcorn Research Laboratories of the School. (Dr. B. Blacklock.)

I also enclose statement showing expenditure of the Government grant for the year ending 31st December, 1913.

I am, &c.,
A. H. MILNE,
Secretary.

Enclosure 1 in No. 1.

SIR, B10, Exchange Buildings, Liverpool, 30th April, 1914.

I BEG to submit the following report on the work done during the period from 1st November, 1913, to the 30th April, 1914.

Students.

The number of medical men who attended the Autumn Term was 19, and the number for the Lent Term, 16; total, 35. This number includes members of the Royal Army Medical Corps, Indian Medical Service, West African Medical Staff, Colonial Medical Service, etc.

Diploma of Tropical Medicine.

The number of candidates for the examination in December was 13, of whom 12 passed. The number of candidates for the April examination was 13, of whom 12 passed.

Museum.

The thanks of the School are due to the following gentlemen for their kindness in sending specimens to the School during the last six months :—

Major J. Davidson, I.M.S., Dehra Dun, India; Dr. C. B. Hunter, Accra; Major W. H. Kenrick, I.M.S., India; Dr. Ricona, Cape Province, South Africa; Major Myles, R.A.M.C., Chester; Dr. W. T. Prout, Liverpool; Dr. Christopherson, Khartoum; Captain W. S. Patton, Madras; Mr. Pillers, Liverpool; Dr. S. Bell, Hong Kong; Dr. D. E. Anderson, Trinidad; Sir Ronald Ross, K.C.B., London; Professor N. Leon, Jasi; Professor E. E. Glynn, Liverpool; Dr. J. Hope Reford, Uganda; Dr. R. W. R. James, Brisbane; Dr. J. Borle, Pretoria; Dr. J. S. Pearson, Sierra Leone; Dr. Keating, Cairo; Dr. M. K. Bhupal, Madras.

Publications.

The following is a summary of the papers contributed during the year by the staff of the School. They are referred to in detail in the various reports appended :

Stephens, J. W. W. Studies in Blackwater Fever. Annals Trop. Med. & Parasitol. Vol. VII. No. 4. December, 1913.

„ A New Malaria Parasite of Man. Annals Trop. Med. & Parasitol. Vol. VIII. No. 1. April, 1914.

Newstead, R. Notes on Scale Insects (Coccidæ). Part II. Bull. Ent. Res. Vol. IV., pp. 301-311. February, 1914.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31ST OCTOBER, 1914.

Yorke, W., & Barratt, J. O. W. The Production of General Symptoms in Hæmoglobinæmia. British Medical Journal. 31st January, 1914.

„ & Blacklock, B. The Differentiation of the more important Mammalian Trypanosomes. Annals Trop. Med. & Parasitol. Vol. VIII. No. 1. April, 1914.

„ & Blacklock, B. Observations on a so-called Cure for Trypanosomiasis. Annals Trop. Med. & Parasitol. Vol. VIII. No. 1. April, 1914.

„ & Blacklock, B. Antimony Trioxide in the Treatment of Experimental Trypanosomiasis. Annals Trop. Med. & Parasitol. Vol. VIII. No. 1. April, 1914.

Blacklock, B., & Yorke, W. The Probable Identity of *Trypanosoma congolense* (Broden) and *T. nanum* (Laveran). Annals Trop. Med & Parasitol. Vol. VII. No. 4. December, 1913.

„ & Yorke, W. *Trypanosoma vivax* in Rabbits. Annals of Trop. Med. & Parasitol. Vol. VII. No. 4. December, 1913.

Fantham, H. B., & Porter, Annie. *Herpetomonas stratiomyiæ,* n. sp. a Flagellate Parasite of the Flies *Stratiomyia chameleon* and *S. potamida,* with Remarks on the Biology of the Hosts. Annals Trop. Med. and Parasitol. Vol. VII. No. 4. December, 1913.

„ & Porter, Annie. The Pathogenicity of *Nosema apis* to Insects other than Hive Bees. Annals Trop. Med. & Parasitol. Vol. VII. No. 4.

„ & Thomson, J. G. The Culture of *Babesia* (Piroplasma) *canis* in vitro. Annals Trop. Med. and Parasitol. Vol. VII. No. 4.

„ & Thomson, J. G. The Successful Cultivation of *Babesia* (Piroplasma) *canis* in Vitro, following the Method of Bass. Transactions of the Society of Tropical Medicine and Hygiene. Vol. VII. No. 3, with 1 plate. January, 1914.

Thomson, J. G., & Thomson, David. The Growth and Sporulation of the Benign and Malignant Tertian Malarial Parasites in the Culture Tube and in the Human Host. Annals Trop. Med. & Parasitol. Vol. VII. No. 4. December, 1913.

Carter, H. F. On Certain Mosquitoes of the Genera *Banksinella,* Theob. and *Tæniorhynchus Arribalzaga,* Annals Trop. Med. & Parasitol. Vol. VII., No. 4. December, 1913.

Seidelin, Harald. On "Vomiting Sickness" in Jamaica. Annals Trop. Med. & Parasitol. Vol. VII. No. 3. November, 1913.

I have, &c.,
J. W. W. Stephens,
Professor of Tropical Medicine.

The Secretary
Incorporated Liverpool School
of Tropical Medicine.

Enclosure 2 in No. 1.

B10, Exchange Buildings, Liverpool, 30th April, 1914.

Department of Medical and General Economic Entomology.

Sir,

I have the honour to submit herewith a report for the half-year ending 30th April, 1914.

(1) The usual courses of instruction were given to the students attending this School for the Diploma in Tropical Medicine. The number of students attending the courses were:—

For the Autumn Term	19
For the Lent Term	16

(2) For the Special Course in Medical and Economic Entomology for Colonial Officers and others, there were present:—

For the Autumn Term	2
For the Lent Term	1

(3) A course of lectures and demonstrations has also been given to the undergraduates and post-graduates in the Veterinary Department of the University.

(4) One advanced student has devoted considerable time to the study of blood-sucking insects, especially of the families Culicidæ and Muscidæ.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31ST OCTOBER, 1914.

Reports and Publications.

1. Notes on Scale Insects (Coccidæ), Part II. Bull. Ent Res. Vol. IV., pp. 301-311. February, 1914.

By Mr. H. F. Carter.

2. On certain Mosquitoes of the Genera *Banksinella, Theob.* and *Tæniorhynchus Arribalzaga,* Annals Trop. Med. & Parasitol. Vol. VII. No. 4, pp. 581-589. 1913.

Identifications of Blood-sucking Insects, Agricultural Pests, etc.

A considerable amount of time has been devoted to the identification of the insects and other arthropoda concerned in the dissemination of disease in man and in the domestic animals, and also numerous insect pests affecting agricultural crops in various parts of the world, including Asia Minor, Africa (over a wide geographical range), West Indies, Central and South America.

The principal institutions from which collections were received are as follows: Imperial Bureau of Entomology (Colonial Office), Musée Royal d'Histoire Naturelle, Belgique; Konigl. Zoologisches Museum, Berlin; Department of Agriculture, Cairo, Egypt; Department of Agriculture, Pretoria.

A tabulated statement of material received and identified is given below:—

	Species.	*Varieties.*	*Specimens.*
Mosquitoes (Culicidæ)	58	2	966
Sandflies (Phlebotomus, Simulium)	2	1	96
Horseflies (Tabanidæ)	33	1	224
Muscidæ (other than tsetses) ...	4	—	205
Tsetses (Glossina)	17	3	1,654
Scale insects (Coccidæ)	13	1	150
Aleurodidæ	1	—	—
General economic	14	—	—
Ixodoidea (ticks)	8	—	184
Total	150	8	3,479

Microscopical preparations only counted.

The total number of specimens examined cannot be given with any degree of accuracy, owing to their minute size.

I have, &c.,
ROBERT NEWSTEAD,
Professor of Entomology.

The Secretary.
Incorporated Liverpool School
of Tropical Medicine.

Enclosure 3 in No. 1.

SIR, B10, Exchange Buildings, Liverpool, 30th April, 1914.

I BEG to submit the following report on my work during the period from 1st November, 1913, to 30th April, 1914.

The report may be considered under the following headings:—

Teaching.

On my return from the Sudan at the end of September, I resumed teaching in Liverpool. Since then I have had the entire responsibility of two full courses in protozoology and helminthology to post-graduate students, the courses extending from October, 1913, to December, 1913, and from January, 1914, to April, 1914. Both lectures and practical work were included for students working for the Diploma in Tropical Medicine, and for the Diploma in Veterinary Hygiene.

I have also spent some time in aiding some of my former students in their research work by examining specimens they have submitted, and giving them summaries and references to literature on the subjects in question.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31ST OCTOBER, 1914.

Research Work.

I have continued my researches on pathogenic spirochætes and amœbæ of man, and have also investigated the blood and intestinal parasites of various mammals, birds, and insects.

I have also continued my work on coccidiosis of poultry, both from the point of view of the life-cycle of the parasites concerned and of preventive and curative treatment. The researches are under the auspices of the Board of Agriculture.

Further details will be found in the publications listed below.

Editorial and Literary Work.

As Editorial Secretary I have been responsible for the publication of three numbers of the Annals of Tropical Medicine and Parasitology. Two of these numbers appeared in 1913, the third—forming the first part of the eighth volume—in April, 1914. I have also reviewed much current literature as Sectional Editor for Protozoology of the Tropical Diseases Bulletin.

A book serving as a good introductory study of the parasitic Protozoa by Dr. Porter and myself was published by Messrs. Methuen & Co., at the end of March, 1914.

Publications :—

1. The Pathogenicity of *Nosema apis* to Insects other than Hive Bees. (With Dr. Porter). Annals Trop. Med. & Parasitol., VII., pp. 569—579.
2. *Herpetomonas stratiomyiæ*, n. sp., a Flagellate Parasite of the Flies *Stratiomyia chameleon* and *S. potamida,* with Remarks on the Biology of the Hosts. (With Dr. Porter). Annals Trop. Med. & Parasitol., VII., pp. 609—620. With one plate.
3. The Culture of *Babesia* (*Piroplasma*) *canis* in vitro. (With Dr. J. G. Thomson). Annals Trop. Med. & Parasitol., VII., pp. 621—632. With one plate.
4. The Successful Cultivation of *Babesia* (*Piroplasma*) *canis* in vitro, following the method of Bass.—Trans. Soc. Trop. Med. & Hyg., VII., pp. 119—125. With one plate.
5. Some Minute Animal Parasites, or Unseen Foes in the Animal World. xi. + 319 pp. With frontispiece and 56 text-figs. Crown 8vo. Methuen & Co., March, 1914.

I have, &c.,
H. B. Fantham,
Lecturer in Parasitology.

The Secretary,
Incorporated Liverpool School
of Tropical Medicine.

Enclosure 4 in No. 1.

Runcorn Research Laboratories,
30th April, 1914.

Sir,

I have the honour to present the following report on the work done at the Runcorn Research Laboratory for the period 1st November, 1913, to 30th April, 1914.

The grant has been used in the upkeep of the laboratory, purchase of apparatus and animals and the maintenance of the latter. The animals are required for the purpose of keeping up a large number of strains of pathogenic protozoa for teaching and research purposes.

In February of this year Dr. Yorke was appointed Professor of Parasitology in the University of Liverpool, and the position of Director here becoming vacant, the Committee of the School appointed me to fill the post.

Professor Yorke in his last report referred to the experimental work which we had been carrying on in testing the value of stibium trioxide in the treatment of trypanosomiasis. Our paper dealing with this work has now been published.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31ST OCTOBER, 1914.

The British South Africa Company having requested Professor Yorke to examine the claims of a Mr. Sieg in regard to a serum which he stated was of value in the cure of trypanosomiasis, we made a series of experiments which proved conclusively that the samples of the serum supplied to us were of no value in the treatment of this disease, even in small laboratory animals.

Professor Yorke has continued his work in conjunction with Dr. J. O. W. Barratt on the subject of the production of general symptoms in hæmoglobinæmia, These experiments were devised with the object of explaining the occurrence of various obscure symptoms in blackwater fever and other allied conditions, and form a continuation of Barratt and Yorke's previous researches on blackwater fever. The results of these experiments are embodied in a paper published in the *British Medical Journal.*

For some time I have been engaged upon experiments in connection with *T. cruzi*, the South American trypanosome of man. This parasite is transmitted in South America by a reduvid bug. The object of the experiments which I have carried out was to ascertain whether the common bed-bug—*Cimex lectularius*—might act as a carrier of this disease. The result of the experiments showed that while the parasite *T. cruzi* could exist for a long period in the bug and remain infective on inoculation into animals, yet the feeding of infected bugs on healthy animals did not, except in one single case, produce infection. It would appear, therefore, that it is extremely improbable that the disease caused by *T. cruzi* could be established and spread through the agency of bed-bugs.

We have made a further study of the morphology and pathogenicity of a short form trypanosome from a horse naturally infected in the Gambia. Morphologically this parasite was identical with *T. congolense* on the one hand and *T. nanum* on the other. The point of interest is that whereas in the early inoculations it strongly resembled *T. nanum* in its pathogenicity, it later became virulent and closely resembled *T. congolense*. As a result of our work we are of opinion that *T. nanum* and *T. congolense* (*T. pecorum*) are one and the same parasite.

The following papers from the laboratory have been published since November, 1913:—

1. Yorke, Warrington, & Blacklock, B. Antimony Trioxide in the Treatment of Experimental Trypanosomiasis. Annals Trop. Med. & Parasitol. 1914. Vol. VIII. No. 1, p. 55.
2. Yorke, Warrington, & Blacklock, B. Observations on a so-called Cure for Trypanosomiasis. Annals Trop. Med. & Parasitol. 1914. Vol. VIII. No. 1, p. 51.
3. Barratt, J. O. W., & Yorke, Warrington. The Production of General Symptoms in Hæmoglobinæmia. British Medical Journal, 31st January, 1914.
4. Blacklock, B. On the Multiplication and Infectivity of *T. cruzi* in *Cimex lectularius*. British Medical Journal, 25th April, 1914.
5. Blacklock, B., & Yorke, Warrington. The Probable Identity of *T. congolense* (Broden) and (*T. nanum* (Laveran). Annals Trop. Med. & Parasitol. Vol. VII. No. 4. December, 1913.

I have, &c.,
B. Blacklock,
Director of Runcorn Research Laboratories.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31ST OCTOBER, 1914.

Enclosure 5 in No. 1.

Liverpool School of Tropical Medicine.

An Account showing the Disposal of the Government Grant for the Year ending 31st December, 1913.

To grant to special research work on trypanosomiasis, towards purchase of animals and upkeep of same, attendants' wages, instruments, chemicals, etc.	£250 0 0	By grant from the Tropical Diseases Research Fund ...	£1,200 0 0
,, Proportion of salaries of research workers on trypanosomiasis at the Runcorn Laboratories	250 0 0		
,, Research work on parasitology and helminthology ...	250 0 0		
,, Research work on entomology	250 0 0		
,, Research work on malaria	200 0 0		
	£1,200 0 0		£1,200 0 0

Examined and compared with the books and vouchers and found correct.

Chalmers, Wade and Company,
Auditors to the Liverpool School of Tropical Medicine.

Liverpool, 29th April, 1914.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31ST OCTOBER, 1914.

No. 2.

LIVERPOOL SCHOOL OF TROPICAL MEDICINE to COLONIAL OFFICE.

(Received 2nd November, 1914.)

Sir, B10, Exchange Buildings, Liverpool, 31st October, 1914.

I have the honour to enclose, for the information of the Tropical Diseases Advisory Committee, the following reports of the Liverpool School of Tropical Medicine for the six months ending 31st October, showing the manner in which the Government grant to the School has been expended, viz :—

(1) Report of the Professor of Tropical Medicine of the School (Professor J. W. W. Stephens).
(2) Report of the Professor of Medical Entomology (Professor Robert Newstead).
(3) Report of the Professor of Parasitology (Professor Warrington Yorke).
(4) Report of the Director of the Runcorn Research Laboratories of the School (Dr. B. Blacklock).
(5) Report of the Lecturer in Parasitology (Dr. H. B. Fantham).

I am, &c.,
A. H. MILNE,
Secretary.

Enclosure 1 in No. 2.

Sir, 31st October, 1914.

I beg to submit the following report on the work done during the period from 1st May to 31st October, 1914.

Students.—The number of students who attended the Advanced Course in June was two. The number of admissions for the Autumn Course is ten.

Museum.—The thanks of the school are due to the following gentlemen for their kindness in sending specimens to the School during the last six months :—

Dr. G. J. Pirie, Lokoja, West Africa; Dr. H. Wolferstan Thomas, Manaos, North Brazil; Mr. N. Pillers, Liverpool; Dr. C. Mackay, British Honduras; Dr. A. J. Chalmers, Khartoum; Dr. W. J. Bruce, Gold Coast, West Africa; Dr. J. W. Scott Macfie, Lagos, West Africa; Professor Emrys Roberts, Cardiff; Dr. H. Reford, East Africa; Dr. R. E. McConnell, Uganda, British East Africa; Major R. H. Kenrick, I.M.S., Pachmari, India; Dr. Corson, Gold Coast, West Africa; Dr. J. Hay, Royal Infirmary, Liverpool.

Blackwater Fever.—The first paper written by myself consists mainly of a statistical study of the relationship between malaria and blackwater. It contains, in addition, a summary survey of the geographical distribution of the disease. I have been able to make many additions to the list of localities usually mentioned in text books.

The second paper consists of statistical matter only. While some of the matter in the first paper has been omitted, it contains several additions which appeared to me to render it of more value than in its original form. I may briefly summarize here some of the results arrived at :—

(1) In 100 cases of blackwater examined on the day before the onset parasites will be found in 73 cases, in 100 cases examined on the day of onset in 47·5, and in 100 cases examined on the day after in 23 (based on an analysis of 350 cases recorded in the literature).

(2) The parasite rate in blackwater fever (irrespective of the day of the disease) is 42·9 per cent. (based on 1,003 cases).

(3) The parasite rate in malaria (routine hospital examinations) is 56·8 per cent. (based on 57,362 cases).

(4) Pigmented leucocytes afford evidence of malaria infection where parasites are absent, e.g., second day of blackwater, 7 cases examined, parasites positive 0, pigmented leucocytes positive 6; fourth to sixth day, 10 cases examined, parasites positive 1, pigmented leucocytes positive 4 (based on 10 cases only).

(5) Post-mortem examinations in blackwater.—Evidence of malaria in 83·9 per cent., negative 16·1 per cent. (based on 31 cases).

(6) In Ancon Hospital, Panama, of 40.928 cases diagnosed as malaria, 102 developed blackwater in hospital. Of 42,000 cases diagnosed as typhoid, pneumonia, etc., four developed blackwater in hospital.

(7) It has been frequently stated that the malignant tertian parasite especially predisposes to blackwater, but this can only be established if each parasite is given an equal chance, so to speak, of affecting this predisposition. An analysis of the Panama (Ancon) data showed that if x cases of malignant tertian give rise to 100, then x cases of simple tertian will give rise only to 88 of blackwater. But, on the other hand, this conclusion was contradicted by the data from Madeira River, Brazil, an analysis of which showed that if x cases of malignant tertian give rise to 100, then x cases of simple tertian will give rise to 185 of blackwater. This discrepancy requires elucidation.

(8) Effect of length of residence in determining susceptibility to blackwater.—This is difficult to determine accurately, as very rarely is it possible to ascertain what the *number of residents* is who have lived one, two, three, etc., years in a colony, and until this is known the number of cases occurring among first year, second year, etc., residents tells one very little. It is obvious, for instance, if no persons have resided longer than five years, no cases will occur among those of six years' residence, as there are no such persons.

I was able to compile two sets of data bearing on this point, from which it appeared :—

(*a*) Among a population of 100, 4·32 cases will occur among first six months residents; 36 among first year residents, 52 among second year residents. The data for subsequent years were not available.

(*b*) 21·3 per cent. of cases occur in first year, 33·0 in second year, 24·9 in the third year, 9·7 in the fourth year (based on 1,050 cases). These figures are, however, based on the assumption that the population of first year, second year, etc., residents is approximately equal. This is probably so for the first two or three years, but is almost certainly not so for later periods.

(9) Seasonal incidence of blackwater.—The figures, though open to criticism, appear to show that there is a seasonal incidence for blackwater fever. But here, again, unless we are comparing equal populations in the various months, the figures are not strictly accurate.

(10) Relationship to malaria.—A laborious examination of the figures regarding malaria and blackwater in Panama, appears to show that not only is there a correlation between the seasonal and secular variations, but also that a coincidence exists between the *magnitude of the oscillations* of the two diseases.

(11) The paper concludes with a chart of the incidence of malaria and blackwater, for the years 1908-1913, among the three populations on the Isthmus, viz.: Americans, Europeans, and Negroes. This chart plainly shows that, as it is chiefly the Europeans who suffer from malaria, so also blackwater fever is almost entirely confined to them.

The third paper, which is now in the press, deals with a schedule for recording cases of blackwater fever. During an examination of the literature, I have experienced great difficulty in getting at the facts regarding particular points which I desired to investigate. From want of any systematic method in recording cases, it was often necessary to read one or more pages before it could be discovered whether a particular fact was recorded or not; and then it was often impossible to say whether absence of any record was equivalent to absence of a particular symptom. This lack of system often made me despair of ever getting at the truth. I have ventured, therefore, to draw up a schedule of symptoms, which I think may be of much value, in two ways, in recording cases. (1) It will save the recorder much unnecessary writing. (2) It will give a systematic statement, *positive* or *negative*, as to the salient symptoms, and at the same time will allow ample space for any additional matter that anyone may wish to add. A few hundred of these schedules carefully filled up would settle definitely the symptomatology and would clear up many other points.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31ST OCTOBER, 1914.

Publications.—The following is a summary of the papers contributed during the year by the staff of the school. They are referred to in detail in the various reports appended:—

Stephens, J. W. W.—Studies in Blackwater Fever, I. Statistical. Annals Tropical Medicine and Parasitology, Vol. VII., No. 2, December, 1913.

,, Blackwater Fever. XVIIth International Congress of Medicine, London, 1914.

,, Studies in Blackwater Fever, II. A Schedule for Recording Cases of Blackwater Fever. (In the press.) Annals of Tropical Medicine and Parasitology.

,, & Roberts.—Banana débris simulating small tape worm segments. (In the press.)

Newstead, R.—Notes on Phlebotomus with Descriptions of New Species. Bulletin of Entomological Research, Vol. V., Part 2, pp. 179-192.

Yorke, W., & Blacklock, B.—The Differentiation of the More Important Mammalian Trypanosomes. Annals of Tropical Medicine and Parasitology, Vol. VIII., No. 1, April, 1914.

,, & Blacklock, B.—The Identity of *T. rhodesiense* with the trypanosome of the same appearance found in game. British Medical Journal, 6th June, 1914.

,, & Barratt, J. O. W.—The Relation of Bile Pigments to Hæmoglobin. (In the press.) Annals of Tropical Medicine and Parasitology, Vol. VIII., No. 3, pp. 497-524.

Fantham, H. B.—The Granule Phase of Spirochætes. Annals of Tropical Medicine and Parasitology, Vol. VIII., No. 3, pp. 575-587.

I have, &c.,
J. W. W. Stephens,
Professor of Tropical Medicine.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B10, Exchange Buildings, Liverpool.

Enclosure 2 in No. 2.

31st October, 1914.

Department of Medical and General Economic Entomology.

Sir,

I have the honour to submit herewith a report for the half-year ending 31st October, 1914.

Students.—(1) The usual courses of instruction were given to the students attending this school for the Diploma in Tropical Medicine. The numbers attending the courses were:—

For the Summer Term (short course)	2
For the Autumn Term (full course)	10

(2) For the special course in Medical and Economic Entomology for Colonial officers and others, there were present:—

Summer Term (June)	4

(3) A course of lectures and demonstrations has also been given to the undergraduates and post-graduates in the Veterinary Department of the University.

Publications.—Notes on Phlebotomus with Descriptions of New Species. Bulletin of Entomological Research, Vol. V., Part 2, pp. 179-192.

Identification of Blood-sucking Insects, Agricultural Pests, etc.—A considerable amount of time has been devoted to the identification of the insects and other arthropoda concerned in the dissemination of disease in man and

the domestic animals, and also numerous insect pests affecting agricultural crops in various parts of the world, including Asia Minor, Africa, over a wide geographical range, West Indies, Central and South America. The principal institutions from which collections were received are as follows:—Imperial Bureau of Entomology (Colonial Office); Musée du Congo Belge, Tervueren, Belgium; Institut Pasteur de Paris; Institut Pasteur d'Algier.

A tabulated statement of material received and identified is given below:—

	Species.	*Varieties.*	*Specimens.*
Mosquitoes (*Culicidæ*)	41	1	837
Sandflies (*Phlebotomus*, *Culicoides*) ...	6	1	100*
Horseflies (*Tabanidæ*)	45	—	267
Muscidæ (other than tsetses)	5	—	38
Tsetse flies (*Glossina*)	15	3	861
Forest flies (*Hippoboscidæ*)	4	—	13
Scale insects (*Coccidæ*)	20	—	200*
Aleurodidæ	1	—	—†
General economic	28	—	—
Ticks (*Ixodoidea*)	15	1	465
Total	180	6	2,781

Before concluding the report of this Department, we desire to tender our sincere thanks to the Imperial Bureau of Entomology, *per* the Director, Mr. Guy A. K. Marshall, for the valuable gift of an extensive collection of blood-sucking insects and ticks, numbering in all 162 species, 8 varieties, and 2,087 specimens.

I have, &c.,
Robt. Newstead,
Professor of Entomology.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B10, Exchange Buildings, Liverpool.

Enclosure 3 in No. 2.

Sir, 31st October, 1914.

I have to submit the following report on the work done by me during the period from 1st May to 31st October, 1914.

Teaching.—During the month of June I delivered a course of lectures on protozoology, and since the middle of September I have been occupied in teaching the students for the Diploma of Tropical Medicine and those for the Diploma of Veterinary Medicine.

Research.—In the course of the last six months I have published three papers. The scope of two of these papers is described in the report of the Director of the Runcorn Research Laboratory. The third paper is a record of experiments done by Dr. J. O. W. Barratt and myself, with a view of elucidating the connexion between the bile pigments and hæmoglobin. This subject is one of considerable difficulty, and the experiments involved somewhat complicated operative technique. The general scheme of the experiments was as follows:—

> A cannula was inserted into the gall bladder of a rabbit, and the ductus communis choledochus was subsequently ligatured. In this manner all the bile secreted by the animal could be collected and examined at regular intervals. In the later experiments the examinations were made at hourly intervals, day and night. The volume of bile passed was estimated, as was also the relative concentration of pigment. No attempt was made to determine the absolute quantity of pigment passed, but the relative concentration was ascertained by comparing the specimens passed one with

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* Microscopical preparations only counted.

† The total number of specimens examined cannot be given with any degree of accuracy, owing to their minute size.

Appendix V.

REPORTS FROM THE LIVERPOOL SCHOOL OF TROPICAL MEDICINE FOR THE YEAR ENDED 31ST OCTOBER, 1914.

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another, by means of a Zeiss comparison spectroscope. The first specimens passed were taken as unity and the concentration of pigment in subsequent specimens expressed as multiples or fractions of the first. Rabbit's bile gives no definite absorption bands but causes a very definite absorption at each end of the spectrum. In comparing different samples of bile, the solutions were diluted until the amount of absorption at each end of the spectrum was equal. A solution of hæmoglobin, prepared by laking the red blood cells of a normal rabbit in distilled water, and after adding sufficient sodium chloride to make the solution isotonic, centrifuging off the red cell stromata, was injected into the marginal vein of the ear of a rabbit, which had been previously operated on in the manner already described. The result of such an injection was the immediate increase both in the volume of bile secreted and also in the concentration of pigment. The increase in concentration and volume was maintained for a period of six to twelve hours.

This work showed clearly that intravenous injections of hæmoglobin are attended by an increased volume of the bile excreted and also by an increased concentration of bile pigment. We were unable, however, to determine whether this increase resulted from an actual conversion of the hæmoglobin introduced into bile pigment, or whether it was merely the result of a stimulation of the liver cells by the hæmoglobin solution. There appears to be no doubt that the increase in volume of the bile excreted depends, at least in part, upon the salt solution in which the hæmoglobin was dissolved, as intravenous introduction of physiological salt solution was followed by a considerable increase in the volume of bile passed; in this case, however, there was no increase in concentration of pigment. It is important to note that these experiments were not attended by the appearance of jaundice. It follows, therefore, that the introduction of large quantities of hæmoglobin into the blood plasma is not necessarily attended by an icteric condition, provided that the outflow of bile be not impeded. This point is of interest in view of the fact that icterus is an almost constant occurrence in blackwater fever.

The following is a list of papers published :—

Yorke, W., & Blacklock, B.—The Differentiation of the more important Mammalian Trypanosomes. Annals of Tropical Medicine and Parasitology, Vol. VIII., No. 1, April, 1914.

„ & Blacklock, B.—The Identity of *T. rhodesiense* with the trypanosome of the same apearance found in game. British Medical Journal, 6th June, 1914.

„ & Barratt, J. O. W.—The Relation of Bile Pigments to Hæmoglobin. (In the press.) Annals of Tropical Medicine and Parasitology, Vol. VIII., No. 3, pp. 497-524.

I have, &c.,
WARRINGTON YORKE,
Professor of Parasitology.

Enclosure 4 in No. 2.

SIR, Runcorn Research Laboratories, 31st October, 1914.

I HAVE the honour to submit the following report of work done at the Runcorn Research Laboratory for the period 1st May to 31st October, 1914.

The grant to the laboratory has been used for upkeep of the laboratory, and purchase and maintenance of the animals required for the purpose of keeping the various strains of pathogenic protozoa.

Several new strains of trypanosomes have been added during the past year, chiefly to serve as comparison strains for the purpose of making a classification of the pathogenic trypanosomes. A classification has been published by Professor Yorke and myself.

I have continued my work in connexion with attempts to transmit *Trypanosoma cruzi*, the human trypanosome from South America, by means of *Cimex*

lectularius. In conjunction with Professor Yorke, I have carried out experiments with a view to elucidating some of the problems in connexion with the production of various symptoms in blackwater fever.

The publication of the results of these experiments will be held over at present, owing to the fact that Professor Yorke and I are setting out immediately on the expedition of the school to Sierra Leone.

The important question whether *T. rhodesiense*, the human trypanosome, and the trypanosome of the same appearance found in game in Africa are identical has of late received considerable attention, and has given rise to some controversy. The German authorities, Kleine, Eckard, and others, hold the view that they are not identical, whereas several British authorities, namely, Kinghorn and Yorke and, more recently, Sir David Bruce, consider them identical in all respects. A paper in which we deal fully with the contentions of Professor Kleine has been published.

The following papers have been published from the laboratory :—

1. Yorke, W., & Blacklock, B.—The Identity of *T. rhodesiense* with the trypanosome of the same appearance found in game. British Medical Journal, 6th June, 1914.
2. ,, & Blacklock, B.—The Differentiation of the more important Mammalian Trypanosomes. Annals of Tropical Medicine and Parasitology, Vol. VIII., No. 1, April, 1914.
3. ,, & Barratt, J. O. W.—The Relation of Bile Pigments to Hæmoglobin. (In the press.) Annals of Tropical Medicine and Parasitology, Vol. III., No. 3, pp. 497-524.

I have, &c.,
B. Blacklock,
Director.

Enclosure 5 in No. 2.

Sir, 31st October, 1914.

I have the honour to report as follows on my work from 1st May to 31st October, 1914.

Teaching.—During June, 1914, I lectured and demonstrated to the students on helminthology, and during the present term have lectured and demonstrated to the Diploma of Tropical Medicine students on certain protozoa.

Research.—I have continued investigations on bronchial spirochætosis, and have extended the scope of the work by comparing and contrasting the organisms with some of those found in the human mouth. The work is still in progress.

I am publishing, very shortly, with Dr. Porter, results of the experimental inoculation and the feeding of insect flagellates to vertebrates, wherein an experimental leishmaniasis, or, strictly, a herpetomoniasis, is produced in the latter.

Researches on microsporidia in bees and allied insects have been continued, as well as observations on avian coccidiosis. A paper on a nosema in humble bees is in the press.

I have still much material collected in Khartoum to examine.

Literary Work.—I have written the section on the protozoa for a book on "The Animal Parasites of Man," now in course of publication by Messrs. Bale & Danielsson.

I have continued the reviewing of current literature on the protozoa as Sectional Editor for Protozoology of the Tropical Diseases Bureau Bulletin, London.

Publications.—The Granule Phase of Spirochætes. Annals of Tropical Medicine and Parasitology, Vol. VIII., pp. 575-587.

I have, &c.,
H. B. Fantham,
Lecturer in Parasitology.

The Secretary,
Incorporated Liverpool School of Tropical Medicine,
B10, Exchange Buildings, Liverpool.

APPENDIX VI.

Report from the Wellcome Tropical Research Laboratories, Khartoum.

(Received 24th December, 1914.)

This report covers the work performed by the Bacteriological Section, and that part of the work of the Entomological Section which is concerned with subjects of interest in Tropical Medicine, of the Wellcome Tropical Research Laboratories, after the change in the Directors in 1913, when Dr. Andrew Balfour, C.M.G., resigned and was succeeded by Dr. Albert J. Chalmers.

The work of the Chemical Section is not mentioned in the present report as it was not concerned, in the period under consideration, with subjects of interest in connexion with the investigation of tropical diseases.

Dr. Fantham, lecturer in the Liverpool School of Tropical Medicine, worked in these laboratories for some time during 1913. He especially studied pathogenic protozoa, but his work, which includes a paper on the morphology of the organisms of bronchial spirochætosis, has not so far appeared in print.

The Laboratory has to gratefully acknowledge generous donations from various sources, and especially one of £E.500 from Mr. Henry S. Wellcome.

The Bacteriological Section.

1. Dr. Chalmers and Captain O'Farrell, R.A.M.C., drew attention to the existence of bronchial spirochætosis in Khartoum, detailing experiments with monkeys, and recording two cases of, apparently, laboratory infection, giving at the same time a general account of the symptomatology as observed by them.

They also gave the differential diagnosis and a method of treatment by an injection of sodium cacodylate, sodium cinnamate, and sodium glycerophosphate, which has since been used in Khartoum, and appears to be useful.

2. Dr. Chalmers and Captain O'Farrell, R.A.M.C., gave a general account of the little recognized disease, "*Pyosis tropica*," together with a specific history of a case in the Sudan which was cured by vaccine therapy.

3. The Trichonocardiases, which are common in Khartoum, were investigated by the same observers, who named the coccus associated with *Trichonocardiasis rubra Micrococcus castellanii*, Chalmers and O'Farrell, 1913. They also gave a general account of the disease with its method of infection and the symptomatology.

4. An epidemic of the same complaint in the Welsh regiment stationed in Khartoum was investigated by Dr. Chalmers and Captain Stirling, R.A.M.C.

The outbreak was traced to a washerman and an improved method of treatment was described.

5. A contribution to the History of Tropical Medicine was made by Dr. Chalmers and Captain Archibald, R.A.M.C., in a paper dealing with two early 18th century treatises which they had in their possession. The principal points of interest were the evidence in favour of the endemicity of yellow fever on the West Coast of Africa at that time, and the account of epidemic gangrenous rectitis which is given in almost similar terms to that published to-day. Apparently dengue fever was observed by these old writers.

6. A curious eruption, appearing after vaccination in a number of Nuba and Nuer recruits, was dealt with in considerable detail by Dr. Chalmers and Captain Byam, R.A.M.C., who were of the opinion that it corresponded with the rash described by the late Dr. Crocker under the heading "vaccine lichen," and never so far reported by any other observer.

7. An extraordinary and apparently new human disease caused by spreading warts was described by Dr. Chalmers and Dr. Christopherson, the Director of the Khartoum and Omdurman Civil Hospitals. These warts, even when situate on the tongue, were associated with a cryptococcus, which was apparently new, and to which they gave the name *Cryptococcus myrmeciæ*, Chalmers and Christopherson, 1914, while the disease they named *Murmekiasmosis amphilaphes*, therein following Galen's nomenclature. They described the pathology, morbid anatomy, symptomatology, diagnosis, and treatment of the disease as well as its prophylaxis.

Appendix VI.

REPORT FROM THE WELLCOME TROPICAL RESEARCH LABORATORIES, KHARTOUM.

Since then they have seen what they consider to be an early stage of the same complaint in another individual, and believe that, being taken in time, the disease will cease to spread.

8. Ringworm of the scalp, as seen in boys in Khartoum and Omdurman, has been inquired into by Dr. Chalmers and Mr. Marshall, Senior Bacteriological Laboratory Assistant.

They found it to be due to a new species of Trichophyton, which they named *Trichophyton currii*, Chalmers and Marshall, 1914.

They gave an account of the history of *Tinea capitis tropicalis* up to the date of publication, together with a differential diagnosis of the Khartoum form from those previously described in the tropics and in the temperate zone. They recommend tobacco-soap to be used in the treatment of the complaint.

9. The morphology of *T. currii* appeared to Chalmers and Marshall to throw so much light upon the classification of the genus *Trichophyton*, Malmsten, 1845, that they contributed a paper upon the subject giving reasons why the genus should be placed in Baranetzky's family *Gymnoascaceæ* of De Bary's *Ascomycetes*, in which finding they support the earlier observations of Matruchot and Dassonville, who for quite different reasons arrived at the same conclusion in 1901.

They are continuing the study of *Tinea capitis tropicalis* as seen in the Sudan, and have already isolated, but have not yet reported, *Trichophyton discoides*, Sabouraud, 1909, in an Egyptian soldier.

10. The causal agent in the sleeping sickness of the Lado has been considered by Dr. Chalmers and Captain O'Farrell, R.A.M.C., who, from comparative morphological considerations, comparative immunity experiments, and comparative human blood serum experiments, are of the opinion that it is the same trypanosome as that found in Uganda and in the Congo.

They point out that, Dutton's original strain of *T. gambiense* having been lost, it is very difficult to be certain as to the nature of the trypanosome which is covered by that name, and are of the opinion that, pending further investigation into the strain causing sleeping sickness in the Gambia, it would be better to use the term *T. castellanii*, Kruse, 1903, for the trypanosome of the Lado. During the immunity experiments they met with granules comparable to those described in kala azar by Archibald.

The same workers are employed at an investigation of the causal organism of the sleeping sickness of the Western Bahr-el-Ghazal.

11. The question of the correctness of using the term Babesia or Piroplasma has been looked into by Dr. Chalmers and Captain Archibald, R.A.M.C., who find that the name *Babesia* being previously used by Trevisan for some micrococci, the correct term for the protozoal organisms is *Piroplasma*.

12. The confused subject of the classification and easy recognition of the species of fungi causing tropical diseases, and included in Fuckel's *Fungi Imperfecti*, has been revised by Dr. Chalmers and Captain Archibald, R.A.M.C., who have found it advantageous to make one new family in order to facilitate practical work.

This paper will appear in the new publication entitled "Year Book of Tropical Medicine and Hygiene," which should be published in 1915.

The references to the papers outlined above are as follows:—

1. Bronchial Spirochætosis (1913). Journal of Tropical Medicine and Hygiene, 1st November.
2. Pyosis Tropica (1913). Journal of Tropical Medicine and Hygiene, 15th December.
3. The Trichonocardiases (1913). Annals of Tropical Medicine and Parasitology, Vol. VII., No. 4, December, page 525.
4. Epidemic Trichonocardiasis (1913). *Ibid*, page 541.
5. Two Early 18th Century Treatises on Tropical Medicine (1914). Transactions of the Royal Society of Medicine, History of Medicine Section, February.
6. Vaccine Lichen in Natives (1914). Journal of Tropical Medicine and Hygiene, 15th May.
7. Murmekiasmosis Amphilaphes (1914). Journal of Tropical Medicine and Hygiene, 1st May.

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8. Tinea Capitis Tropicalis (1914). *Ibid*, 1st September.
9. Sleeping Sickness in the Lado (1914). *Ibid*, 15th September.
10. The Systemic Position of the Genus Trichophyton, Malmsten, 1845 (1914). *Ibid*, 1st October.
11. Babesia or Piroplasma (1914). *Ibid*, 1st November.

Nearly all these papers contain photographs and photomicrographs illustrating the subject matter.

The following is a brief account of the work performed by Captain Archibald, R.A.M.C., Pathologist to these laboratories, in addition to the papers indicated above.

13. *Aspergillosis in the Sudan Ostrich.* Journal of Comparative Pathology and Therapeutics, June, 1913.—This paper records for the first time in the Sudan the presence of this disease in the lung of an ostrich from Western Kordofan.

From the information obtained the bird was the last of a brood that had died from this disease, thus illustrating the pathogenic properties shown by certain fungi which exist in nature as mere saprophytes. The paper describes the morbid anatomy and histology of the disease as shown in the specimen sent to these laboratories.

14. *An Interesting Case of Kala Azar.* Journal of the Royal Army Medical Corps, May, 1913.—This paper gives an account of a peculiar case of kala azar, in which the writer failed to obtain the parasites of leishmania in the spleen and liver, even after repeated punctures of these organs. Clinically, the case resembled kala azar, and intraperitoneal inoculation of an emulsion of the spleen and liver produced the disease and the parasites of leishmania in a monkey.

The case was of interest owing to the presence of peculiar "coccal bodies" found in the liver and spleen smears. The writer was unable to determine the exact nature of these "coccal bodies," but is of the opinion that they are related in some way to leishmania.

It is of interest to note that since this paper has been published other observers in the West Coast of Africa have found these coccal bodies in cases of splenomegaly of uncertain origin. They have also been recorded in a case of Mediterranean kala azar, and Row has also observed them in leishmania infections met with in India.

The paper concludes by calling attention to the presence of a large lymphocytosis present in the peripheral blood of kala azar cases, and also to the development of an eosinophilia in cases that are recovering from this disease. This latter feature was present in the recovered case described in the paper.

15. *A Case of Acute Ankylostomiasis treated by a Vaccine.* Journal of Tropical Medicine and Hygiene, July, 1913.—This paper describes a case of acute ankylostomiasis, in which the patient showed grave anæmia, splenomegaly, and pyrexia. The usual helminth remedies were tried but without success. The fæces were plated out, and a vaccine prepared from the predominant organism isolated. Injections of the vaccine produced most beneficial results. The temperature soon fell to normal, the spleen and liver returned to their usual size, and the patient made a complete and rapid recovery, although ankylostome ova were still present in his stools. The paper calls attention to the fact that some cases of acute ankylostomiasis are in reality intestinal toxæmias, resultant on the absorptions of toxins from the intestinal flora, and that the ankylostoma *per se* is not always the sole agent accountable for the symptoms. In such cases the writer suggests a vaccine treatment combined with the usual helminth remedies.

16. *Intestinal Schistosomiasis in the Sudan.* British Medical Journal, 7th February, 1914.—In this paper the writer calls attention to a specific fever in the Sudan, acute or chronic in type, which is dependent on an infection with *Schistosoma mansoni.* The fever frequently resembles enteric and is often mistaken for that disease.

It is usually accompanied by splenic enlargement, a varying degree of anæmia and a polymorphonuclear leucocytosis. In the more chronic cases the liver becomes enlarged. Intestinal symptoms may or may not be present. The diagnosis is made by a careful examination of the fæces, which may have to be repeated several times before the ova of *Schistosoma mansoni* are found.

An eosinophilia in the peripheral blood is frequently absent, a negative sign, which may be rather misleading.

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The writer records two cases that were benefited by injections of autogenous coli vaccines, and considers that the signs and symptoms in many of these cases are dependent on an intestinal toxæmia caused by coli-like organisms. This view receives some support from the fact that in the serum tests of these cases a group reaction with *B. typhosus* is often obtained.

17. *Emetine Treatment of Dysentery in Young Children.*—This paper describes two cases of entamœbic dysentery in very young children.

The causal agent was *E. tetragena.* In the one case the entamœbæ possessed resistant properties to the action of the drug emetine, a point which has been observed in other cases of amœbic dysentery in the Sudan.

The main points in this paper are as follows:—

(*a*) In severe cases of entamœbic dysentery it is advisable to commence with an initial dose of $\frac{1}{6}$ grain emetine for a child of 2, and repeat this dose every twelve hours till a total of $\frac{1}{2}$ grain has been given.

(*b*) The total amount of emetine administered should be controlled by the evidence obtained by microscopical examination of the stools, a procedure which should also be carried out at intervals during convalescence.

(*c*) In order to avert relapses, the continued treatment by emetine after the patient's apparent recovery would be advisable.

(*d*) In entamœbic dysentery of the Sudan emetine may require to be given in larger doses than are usually employed in other countries.

18. *A Preliminary Report on some further Investigations on Kala Azar in the Sudan.* (Awaiting publication in the Royal Army Medical Corps Journal.)—This paper is too long to be quoted from, but the main points, briefly summarized, are as follows:—

(*a*) Kala azar infections were produced by intraperitoneal inoculations in the following animals:—grey monkey, pup, jerboa, and gerbil—while guinea-pigs, rabbits, cats, kittens, pigeons, and a cheetah failed to show infection.

(*b*) Experiments carried out with cultures of *Leishmania donovani* tend to show that the flagellates are possessed of no mean vitality, and when exposed to unfavourable conditions short of immediate death revert to a cystic stage.

(*c*) Human blood serum has an almost immediate destructive effect on cultures of *Leishmania donovani.*

(*d*) Specific agglutinins are not present in the serum of patients suffering from kala azar.

(*e*) Kala azar may occur as a concomitant infection with filariasis.

(*f*) Intraperitoneal inoculations with cultures produced infection in the grey monkey and the jerboa, but failed to produce infection in white mice, a pup, a wild cat, a guinea-pig, and a domestic cat.

(*g*) A susceptible animal fed with the fæces of a case of kala azar failed to contract infection.

(*h*) Infection was established on two different occasions by feeding grey monkeys with infected material containing kala azar parasites.

(*i*) Cultures introduced into the vagina of a healthy female monkey failed to produce the disease.

(*j*) Vaccinations with cultures failed to produce infection in a grey monkey.

(*k*) Epidemiological and experimental evidence does not support the theory that kala azar in the Sudan is transmitted by a biting insect. A more probable source of infection appears to be some intermediate host, whose habitat is in water.

(*l*) No natural host has been found among the numerous animals examined in the Sudan.

Captain O'Farrell, R.A.M.C., Protozoologist to these laboratories, submits the following report of work in addition to that detailed above:—

19. *Preliminary Note on a New Flagellate, Crithidia hyalommæ, Sp. Nov., found in the tick Hyalomma ægyptium* (*Linnæus*, 1758). Journal of Tropical Medicine and Hygiene, 15th August, 1913.—The article briefly described and named

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a species of crithidia new to science. The discovery illustrated another case of hyper-parasitism, a subject which has received considerable attention during recent years.

The host of the crithidia was the common cattle tick (*Hyalomma ægyptium* (Linnæus, 1785)) of the Anglo-Egyptian Sudan, which is also a fairly widespread cattle parasite in tropical Africa.

An interesting point about this parasite, which has been named *Crithidia hyalommæ*, is that it is believed to be the highest form of protozoal parasite which has as yet been discovered in the class Arachnoidea.

20. *Hereditary Infection, with Special Reference to its Occurrence in Hyalomma ægyptium infected with Crithidia hyalommæ.* Annals of Tropical Medicine and Parasitology, Vol. VII., No. 4, December, 1913.—This publication, with illustrations, was concerned with further researches on the life history of *Crithidia hyalommæ.*

A description was given in the text, and illustrations were inserted showing the different changes the parasite underwent during a process of hereditary transmission, beginning with the infection of the immature tick ovum, and continued in the mature egg after its separation from the parent.

Although hereditary infection has been described before in flagellate protozoa, its occurrence has been doubted by some, but this paper provides a new example, and supports the work of those other authors who have demonstrated such an infection.

Mr. Marshall's Work.

21. Mr. Marshall, Senior Bacteriological Laboratory Assistant, has experimented with the application to pathological amœbæ of the Oxford method of staining fungal spores.

He finds that the resultant preparation resembles those produced by the iron-hæmatoxylin method, the advantage of the Oxford stain being that it is simpler and more easily applied.

His investigations have been published in "The Laboratory Journal," for September, 1914, under the heading "A Simple Method of Staining the Amœbæ Parasitic in Man."

Entomological Section.

During the last eighteen months the following papers of medical interest have been published by this section of the laboratories, which is in the charge of Mr. Harold H. King, F.E.S., F.L.S. :—

22. H. H. King. *Observations on the Breeding Places of Sand Flies (Phlebotomus spp.) in the Anglo-Egyptian Sudan.* Journal of Tropical Medicine and Hygiene, 1st January, 1914.—Attention is drawn to the fact that in other countries the immature forms of *Phlebotomus* spp. have with but one exception been found living in association with either stones, bricks, tiles, or cement. Reference is made to the finding, by the writer, of a single larva in soil in a cotton field at Tokar, and the rearing from the larval stage of a number of adult *P. papatasii* in soil, in jars in the laboratory, is recorded. The writer considers that the immature forms of this species are not as susceptible to extremes of moisture and drought as had hitherto been supposed, and believes that, while in all probability many sand flies in the Anglo-Egyptian Sudan, as in other countries, breed in crevices in walls and similar situations, an equally favourite, if not the more normal, breeding place, is the soil.

23. A. J. Chalmers and H. H. King. *The Distribution of Glossina longipennis* (*Corti*, 1895). Journal of Tropical Medicine and Hygiene, 15th October, 1913.

The writers record the capture of specimens of *G. longipennis* in two localities near the south-eastern boundary of the Anglo-Egyptian Sudan and give the entire distribution, as at present known, of this species, illustrated with a map.

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24. H. H. King. *Further Notes on the Bionomics of Tabanus ditæniatus, Macquart, and Tabanus tæniola, Palisot de Beauvois.* (Awaiting publication in the Bulletin of Entomological Research.)—The writer refers to a previous paper in which he recorded the rearing of the mature larva from the egg of *T. tæniola* and the adult from the immature larva of *T. ditæniatus*, and described the various immature forms obtained of these two species. In the present paper the puparium of *T. tæniola* and the egg mass of *T. ditæniatus* are described and figured. Mention is made of a hymenopterous parasite, probably a *Telenomus* sp. having been bred from egg masses of the latter species.

ALBERT J. CHALMERS,
Director, Wellcome Tropical
Research Laboratories.

Khartoum,
2nd December, 1914.

APPENDIX VII.

Observations on the Life-History of Dermatobia Hominis (Linnæus Jun., 1781), by Dr. Louis W. Sambon.

In the course of a recent journey to South America and to the West Indies, for the purpose of investigating pellagra, I had the opportunity of examining several cases of cutaneous myiasis, both in man and animals, and of acquiring some interesting information concerning the bionomics of *Dermatobia hominis*, a warble-fly, the larva of which is a common parasite of man in certain regions of Intertropical America.

My observations were made in Cartagena (Colombia), in British Guiana, and in the island of Trinidad. Necessarily they were quite casual, but they aroused my interest so greatly that I feel anxious to urge a more thorough investigation of the natural history of Dermatobia and other Œstrids.

The life-histories of many animal parasites, as instanced by those, now well known, of the malaria germs (*Plasmodium malariæ, P. vivax, P. falciparum*), of the sheep liver fluke (*Fasciola hepatica*), of the passerine intestinal fluke (*Distoma macrostomum*), of *Agchylostoma duodenale* and of *Filaria bancrofti*, are so marvellous that recent manuals of parasitology and tropical medicine contain far greater wonders than our old books of legends and fairy tales. And I have no doubt that the natural history of *Dermatobia hominis*, when fully disclosed, will prove a far more extraordinary tale than any we have listened to so far at the knee of Modern Science.

History of Œstrids.

The injurious Œstrid larvæ must have been known to man from the earliest days of cattle-raising. They are mentioned on Babylonian tablets and Egyptian papyri, in Greek, Roman, and mediæval literature, but their true nature does not seem to have been clearly understood until the beginning of the eighteenth century, when a great Italian physician, Antonio Vallisneri, published his observations on the ox warble-fly (*Hypoderma bovis*), the sheep head-maggot (*Œstrus ovis*), and the horse bot-flies (*Gastrophilus intestinalis* and *G. hæmorrhoidalis*).

Aristotle mentions the occurrence of living worms (larvæ of species of Cephenomyia) in the pharyngeal cavities of deer, and appropriately compares these "worms" to the maggots that live in decaying meats. Eumelus of Thebes, Theomnestes, veterinarian to Theodoric the Great, the superstitious Pelagonius, Apsyrtus, a famous veterinarian of the first half of the fourth century after Christ, and Hierocles, the lawyer, mention the larvæ of *Gastrophilus hæmorrhoidalis* by the name of τερηδονες, and give directions for the removal of the same from the rectum, where they may be found in large numbers at the time of incipient pupation. They judiciously advise the destruction of the voided larvæ by means of hot ashes poured over them.

The very old popular belief, that bees and wasps are produced from the decomposing carcases of oxen and horses, probably arose from a confused knowledge of the metamorphoses of bot-flies, drone-flies, warble-flies, and flesh-flies. Some of the bot-flies do certainly present a striking superficial resemblance to various kinds of bees, and the term "bee" was at one time also applied to bot-flies and other dipterous insects. Thus "gad-bee" was a name frequently used to indicate the "gad-fly."

Homer, Virgil, Oppian, and other Greek and Roman poets have graphically described the wild terror of oxen tormented by the "Œstrus," and entomologists have often quoted these vivid word-pictures, applying them to the ox warble-fly. But the "Œstrus" of the ancients was a Tabanid, not an Œstrid. Aristotle tells us quite clearly that the insect he calls οιστρος is provided with strong piercing mouth parts, that it is a blood-sucker, and that it develops from a free-living larva inhabiting marshy places. Ælian also describes the "Œstrus" as one of the largest flies, provided with powerful piercing trophi and producing a harassing buzzing noise. Whilst in the Roman Compagna in 1900, I had many opportunities of watching the behaviour of cattle and horses tormented by the stabs and terrified by the loud perturbing buzz of gad-flies (Tabanus) and breeze-flies (Hæmatopota), and I have seen them, as described by the ancient authors, suddenly gallop off in a frenzy. The

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horses, in order to protect themselves from the attacks of these cruel, maddening flies, used to form into close rings with their heads all meeting at the centre. Sometimes thirty, forty, or more horses might be seen thus clustered in the middle of a field, and there they would stand, throughout the hottest part of the day, constantly stamping their feet, tossing their manes, and lashing with their tails.

Not infrequently, in the course of time, the meaning of certain names has changed; therefore it is necessary to be careful and discriminating in the interpretation of old texts. Thus, in reading of "insects," "worms," or "serpents" in the writings of bygone centuries, we should put aside the present-day restricted and scientific meaning of these terms and adopt the older, wider, and more popular conceptions. The older and wider meaning of the term "worm" still lingers in the popular names of certain animals such as the "glow-worm," which is an insect, and the "blind-worm," which is a lizard. On the other hand, certain true worms such as the *Filariidæ*, were called "serpents," and the present-day scientific name *Dracunculus* given to one genus is but a survival of the old appellation.

Blundeville, who wrote on farriery during the reign of Queen Elizabeth, describes the horse bot-fly larvæ as "worms short and thick, like one end of a man's little finger" and calls them "truncheons," whilst he gives the name of "bots" to a "second sort of worms which have great heads and small long tails, like a needle" (probably the long-tailed Oxyuris = *Oxyuris mastigodes*). In mediæval England, a cow with its hide perforated by warbles or wormuls (corruption of worm-holes) was said to be elf-shot: the holes being made by the arrows of little malignant fairies, who were accused also of producing galls in plants. The remedy consisted in charms, and in Scot's "Discovery of Witchcraft," printed in 1651, we find a "Charm for the bots in a horse."

> "You must both say and do thus upon the diseased horse three days together, before the sun rising: *In nomine pa+tris & fi+lii & Spiritus+sancti, Exorcize te vermen per Deum pa+trem & fi+lium & Spiritum+sanctum*: that is, In the name of God the father, the sonne, and the Holy Ghost, I conjure thee, O worm, by God the Father, the sonne, and the Holy Ghost; that thou neither eate nor drink the flesh, blood, or bones of this horse; and that thou hereby maiest be made as patient as Job, and as good as S. John Baptist when he baptized Christ in Jordan, *In nomine pa+tris & fi+lii*, et *Spiritus+sancti.* And then say three *Pater nosters*, and three *Aves*, in the right eare of the horse, to the glory of the Holy Trinity. *Do+minus fili+us spirit+us Mari+a.*"

Miss Ormerod (1886) tells us how, even at the present day, in Ireland charms are still used against the warbles:—

> "The 'charmer' is generally an old woman. When she enters the stable of the sick cow, she calls for some butter or lard. After it has been placed before her, she prays for a time to some spirit. After the spirit of destruction is exorcised she takes the butter and gently covers the breathing aperture of the maggot and crosses it. The result of all this is that the maggots die, and fall, or are easily picked out, without causing the least pain."

But in all times, by the side of ignorance and superstition, we find the true spirit of observation and research. Thus, in his "Theater of Insects," Thomas Mouffet, an English physician of the sixteenth century, mentions an observation which proves that the oviposition of the horse bot-fly (*Gastrophilus intestinalis*) had been noticed in his day. He says:—

> "This Kinde of Fly called a *Whame* and a *Burrel-fly* is almost like the Bee in shape and colour, only it is bigger in body. It doth not cleave to the flesh, nor suck bloud as others do, but only stings with its tail, flying a long way after horses and stinging them in their travel. Horses are naturally afraid of this Fly, whom upon the least touch, they endeavour by what means possible with their tails, feet and mouths, to drive away. Some are of a mind that these flies do not indeed use a sting, or prick, but with their tails they fasten their dung (?ova) to the horses' hair, from whence a while after come a number of very irksome Nits."

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Bionomics of best known Œstrids.

Hitherto our conception of the life-history of *Dermatobia hominis* has been based on scanty information and erroneous analogies. In order to reach the correct interpretation it is not only necessary to study all the available data, both old and recent, concerning this fly, but, in addition, we should have before us the most recent information concerning the bionomics of other better known Œstrids.

Pasturing horses are attacked, often simultaneously, by several species of Gastrophilus (*G. intestinalis, G. hæmorrhoidalis, G. nasalis, G. pecorum*), all of which go through a very similar life-history. The ovipositing bot-flies may be seen hovering and buzzing round their victims (horses, asses, mules) from about June to September, during the hottest hours of the day. The fly oviposits whilst on the wing, darting suddenly towards the skin with the body bent downwards and the ovipositor fully extended. The eggs are glued, one by one, to the hairs of those parts of the quadruped's body which are more easily and frequently licked. *Gastrophilus intestinalis*, as a rule, selects the forelegs and shoulders. *G. hæmorrhoidalis* and *G. nasalis* choose the hairs of the lips and nostrils. After some days the eggs are ready to hatch and burst open at the slightest touch of the horse's moist tongue. By means of the tongue the young larvæ reach the oral cavity. In the spring months we find them full grown; those of *G. intestinalis* hooked upon the walls of the stomach, so numerous at times that Gaspari compared the affected organ to a bursting pomegranate; those of *G. hæmorrhoidalis* and *G. nasalis* in the duodenum or the rectum, ready to leave their host with the excreta, drop to the ground and pupate. The pupal stage lasts from about thirty to forty days.

The sheep bot-fly (*Œstrus ovis*) is seen from June to September. It is viviparous and is believed to deposit its young larvæ at the entrance of the nasal passages of sheep and goats. The full-grown larvæ are found in the frontal and maxillary sinuses. They begin to give trouble in April, and drop out of the nostrils to pupate in May, June, or July. The pupal stage lasts from forty to fifty or more days.

Oxen, in several parts of the world, are attacked by two species of Hypoderma (*H. bovis* and *H. lineata*) which present a very similar life-history. Oviposition occurs from the middle of June to the middle of August. The fly approaches very swiftly and glues its eggs on the hairs of the fore-legs, flanks, belly or tail, but preferably near the heel, hence the popular name of "heel-fly," given in America to *Hypoderma lineata*, and the reason why, during the summer months, cattle will stand knee-deep in water the greater part of the day, or will rush off in a frenzied state, with outstretched neck and tail erect, to the nearest water at the approach of the dreaded fly. The eggs are laid singly (*Hypoderma bovis*) or from four to six (*Hypoderma lineata*) are fastened side by side to the same hair, all containing a well-developed larva ready to hatch as soon as laid. The fully grown larvæ are found in swellings which develop beneath the skin of the back and sides. These swellings, the so-called "warbles," begin to appear from January or February. They reach their maximum size in April, May, or June, when the larvæ begin to fall out. Few remain so late as July or August. The pupal stage lasts from twenty-six to thirty days.

Réaumur, in 1740, believed that the ox warble-fly (*Hypoderma bovis*) pierced the back and flanks of cattle by means of its ovipositor and thrust an egg within each wound, well beneath the hide, but Modeer, in 1786, and Bracy-Clark, in 1825, showed that the ovipositor is not adapted for boring and could only serve the purpose of fixing the eggs on to the hairs.

To an American veterinarian, Dr. Cooper Curtice, we owe the most striking and important advance ever made in our knowledge of the life-history of the Œstrids. He showed that the ova of *Hypoderma lineata*, like those of the horse bot-flies, are licked off the hair by the nit-covered oxen, that the young larvæ, on being swallowed, penetrate the œsophageal walls, shed their spinous cuticles, and, sooner or later, after wandering through the tissues, reach the skin from within and settle for further development in those parts where the warbles usually appear. These strange and hitherto unsuspected wanderings are proved by the fact that the larvæ are found embedded in the walls of the œsophagus, frequently in great

numbers, from July to December, and that at the time of their immigration that organ shows marked inflammatory reaction. By the latter part of January or beginning of February all the larvæ have disappeared from the œsophagus, which has resumed its normal appearance. Then the larvæ begin to make their appearance beneath the skin of the back, many reaching their destination already by the end of December or the beginning of January. Meanwhile, during the period of their migration, they may be found in any part of the body.

Already, in 1888, Hinrichsen, a Dutch veterinary surgeon, had found the young larvæ of *Hypoderma bovis* lying between periosteum and dura mater in the spinal canal, but he failed to recognize the significance of his finding.

In 1898, Koorevaar published some very interesting observations and researches on the migrations of the Hypoderma larvæ within the body of cattle. Towards the end of June he found in the wall of the œsophagus minute hyaline larvæ, the smallest of which were scarcely two, the largest three to four millimetres long. During the succeeding months the larvæ were found throughout the whole extent of the œsophagus, from the pharynx to the cardiac orifice. They were embedded between the mucosa and the muscular layer. In July some of the larvæ in the cervical portions of the œsophagus were found to have made their way into the connective tissue surrounding it. By the middle of August some specimens, five millimetres long, were discovered in the subdural fat of the spinal canal. During the autumn months larvæ, varying in length from five to thirteen millimetres, were still found in the œsophagus. The majority, however, had already migrated into the spinal canal. From October to January one could often find as many as forty larvæ within the spinal canal of a single animal. In young cattle as many as fifty-seven larvæ were found distributed throughout the whole length of the vertebral canal, from the neck to the *cauda equina*. Frequently larvæ of the same size were found in the œsophagus and in the subdural fat. By the end of December, Koorevaar noticed a brownish, hæmorrhagic œdema in the subcutis, which indicated the arrival of the larvæ at the point of their final development. However, during the winter months it is by no means rare to find Hypoderma larvæ simultaneously in the œsophagus, the subdural fat, and the subcutis of the same animal.

On one occasion Koorevaar inserted eleven Hypoderma larvæ, from a calf, beneath the skin in the left lumbar region of a small dog. Eight days later fifteen more were introduced beneath the skin of the right side. A period of fourteen days was allowed to elapse, then the dog was killed and dissected. Of the twenty-six larvæ placed beneath the skin of this dog, five were found still in the subcutis, six lying free in the peritoneal cavity between the folds of the intestines, five in the fat round the spleen and kidneys, three on the psoas muscle, three in the wall of the œsophagus, two in the peri-tracheal tissue, and two in the subdural adipose tissue. Notwithstanding these extensive migrations, no traces of their passage could be detected in any part of the host, in spite of careful observations.

ŒSTRID LARVÆ IN MAN.

In the "*Medicinale Anglicum*," or "The Leech Book of Bald," written in the former half of the tenth century, we find mentioned a "worm" which, judging from the brief description and from the remedies suggested, may probably have been the Hypoderma maggot. It is called the "ana-worm which grows in man," and is referred to as follows :—

> "If the worm eat through to the outside and make a hole, take a drop of honey, drop it in the hole, then have broken glass ready ground, shed it on the hole, then as soon as the worm tastes of this, he will die."
>
> "A salve against the ana-worm thus shall a man work it; take cinquefoil, that is five-leave grass, and rue; boil them in butter, sweeten with honey."

By the name of "bovine disease" the Arabian physicians of the eleventh and twelfth centuries mention a parasitic affection of man which may have been the "creeping disease" of modern authors. Albucasis (Book 2, chapter 92) describes it thus :—

> "This disease is called in some of our towns the bovine sickness from its being common to oxen. It is a small worm, bred between the skin and the

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flesh, which creeps about the whole body either moving upward or downward. It is perceptible during its migrations from part to part until it breaks out, wherever it is possible to pierce the skin, and comes out. It is bred from the putrefaction of certain humours, as is the case both with worms and with the eelworms (Ascarides) and gourd-worms (Cestoda) of the guts, and may give rise to dangerous consequences when, wandering about the body and ascending to the head, it reaches the eye; because it frequently makes an opening in it and escapes, injuring the eye, the which happens very often. In order to cure it and extract it, the attempt should be made during its wanderings, as soon as it is noticed. It is then necessary to bind the parts which are above and below it with a very strong ligature, then cut down to it and extract it. But if it has burrowed into the flesh and cannot be found, then one should cauterise the place until it is burnt. However, as already stated, the danger most to be feared from it is the corruption of the eye. Therefore, if you see it already in the head coming close to the eye, tie the eyebrow beneath it by means of a strong ligature, and making an incision down to it, draw it out. It is also necessary that the patient diligently assist and take care to cleanse his body with solvent medicines which purge the corrupt and bad humours, and let him avoid such foods as may generate putrefaction. This being the pleasure of God Almighty."

This description might also apply to infection by certain Filariidæ, such as *Dracunculus medinensis* and *Loa loa*, but Avenzoar dismisses dracontiasis, because, speaking of the treatment of the "bovine sickness," he says that the patient should be purged "with the same drugs that are administered for the *vena medinensis*." Moreover, the Arabian authors state that the bovine sickness worm "proceeds from the same kind of humour as Lice and Nits," and, like several modern physicians and entomologists, mistaking the posterior extremity with its dark stigmata for the anterior portion of the maggot, say that "its head is black."

In 1854, Dr. J. Matthews Duncan published a case of cutaneous myiasis in the human subject. He stated that he had extracted the larva of *Œstrus* (=*Hypoderma*) *bovis* from the skin of a girl, aged twelve, who had been employed in herding cattle. There was a small tumour, like a boil, with a small opening at the apex. On attentive examination he saw something moving in the interior, and, without difficulty, extracted the maggot; a little fluid containing blood and purulent matter escaping at the same time. On inquiry, Dr. Duncan found that it was the third which the girl had observed on her person. In the present instance the maggot was first perceived over the spine, at the dorsal vertebræ; it then progressed into the neck, disappeared, and was again felt on the right side of the neck, whence it was extracted. According to Dr. R. Walker, who described a case in 1870, this parasitic disease is of frequent occurrence in the Shetland Islands.

In 1879, Professor Berretta published a case of myiasis he had had the opportunity of observing in Catania, Sicily. The patient was a small boy, employed in herding cattle. The parasite was lodged beneath the skin of the nape of the neck. After extraction it was submitted to Professor Aradas, who found it to be the larva of *Hypoderma bovis*.

According to Schöyen (1891) cutaneous myiasis in man has been known to occur in certain districts of Norway for over a century. He says, "Many of these grubs I have seen and examined myself, and all of them were the larvæ of Hypoderma (*sine dubio Hypoderma bovis*). As a rule they had made long excursions beneath the skin, always in an upward direction, before appearing through an opening in a swelling on the upper part of the body (head, neck, shoulders, etc.). All lived in this way for months, and came out during the winter (February), but were always much too young to metamorphose. However, I have no doubt that they belong to *Hypoderma bovis*, because it is especially in persons employed in the herding of cattle during summer that these maggots are seen in the winter months. It is evidently the smell of cattle that attracts the warble-fly."

Dr. Riley (1891) also records the extensive wandering in a child of a grub which was referred to *Hypoderma diana* of deer, but later shown to be *Hypoderma lineata*. The case had occurred, in 1889, in Smethport, McKean County, Pa.,

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United States of America. Another American case was published by Dr. R. T. Miller in 1910. The extracted larva was identified by Dr. Ch. Wardell Stiles as "the larva of *Hypoderma lineata* in the second stage."

The larvæ of several species of bot-flies (*Gastrophilus hæmorrhoidalis, G. nasalis, and G. pecorum*) have been observed in man. In 1877, Schoch published the case of a woman suffering from chronic gastritis, in whose evacuations and vomited matters were found the larvæ of an Œstrid, but the species was not determined. In 1879, Portchinsky mentioned a case reported by Dibovsky from the neighbourhood of Irkoutsk, Siberia. The patient complained of gastric attacks, the cause of which could not be discovered. A lama (priest) recognized the condition, which, to his saying, was common in the locality. The administration of a native remedy brought about the expulsion of maggots, which, examined by Portchinsky, proved to be the larvæ of *Gastrophilus pecorum.*

Far more frequent are the cases of cutaneous myiasis due to the very young larvæ of various species of Gastrophilus (*G. hæmorrhoidalis, G. nasalis*). This form of myiasis has been observed in several parts of Russia, such as Perm, Viatka, Oufa, Saratov. The Russian peasants call it *volosse, or volossatnike*, which means hair, and the name is descriptive of the red hair-like tracing on the skin which marks the progress of the larva beneath it. The disease occurs in persons who are constantly in contact with horses, the newly-hatched larvæ passing, as a rule, from the sweaty coat of the horse to the hands of man, but, according to Sokolov, the female bot-fly may oviposit directly on to the human subject. Its eggs have been found firmly attached to the eyebrows, to the eyelashes, and to the downy hairs on the face of patients suffering from this form of myiasis. Similar cutaneous lesions, due to the migrations of the immature Gastrophilus larvæ, have been observed in the horse by French army veterinary surgeons, especially in the east of France, about Verdun, Châlons, and in the valley of the Meuse.

These observations suggest that the larvæ of Gastrophilus, like those of Hypoderma, may also spend an early quiescent period within certain organs and tissues, and then migrate, in due season, to their respective anatomical habitats, where we usually find them undergoing rapid development towards pupation. And this may be the case not only in warble-flies and bot-flies, but also in other genera of Œstrids, such as *Rhinostrus* and *Œstrus.*

Dermatobia hominis.

Professor R. Blanchard, in a remarkable series of studies on the parasitic Diptera, published between 1893 and 1896, proved that the Œstrid larvæ commonly affecting man in tropical America, and bearing different names in the various countries, belonged to one species, the *Cuterebra noxialis* Goudot, the differences in size and shape being merely the appearances of different developmental stages. He also pointed out that *Cuterebra noxialis* Goudot, 1845, was identical with *Dermatobia cyaniventris* Macquart, 1843.

The specific identity of the various larval forms had already been suspected by Professor P. S. de Magalhães, who, in 1892, wrote: "The simultaneous presence of the three principal forms of Dermatobia larvæ within so limited an area as the geographical zone, including the States of Rio de Janeiro, São Paulo, and Minas Geraes, would not be an argument unfavourable to the hypothesis of the possible specific unity of the three varieties."

Likewise, the identity of *Dermatobia noxialis* and *Dermatobia cyaniventris* had long been suspected by Professor Brauer, who, in his monograph on the Œstridæ, published in 1863, though admitting the two species, considers them hardly distinguishable, the distinction being based solely on certain characters of the hair clothing of the abdomen, which had not been indicated by Macquart in the description of his type specimen. Indeed, Goudot himself says: "This species (*C. noxialis*) is closely allied to the *Cuterebra cyaniventris* of Macquart, differing, however, on account of the abdomen being provided with small black hairs, and having whitish hairs at the base, otherwise the description given by that *savant* corresponds fairly well with the species under consideration."

Macquart's description is as follows:—

"*Cyaneus. Antennis flavis. Pedibus rufis. Long.* 5½ 1 ♀.. Face yellow. Front

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black, with greyish down and base testaceous. Antennæ yellow; third joint four times as long as the second; arista apparently feathered on the upper side alone. Thorax of a bluish-black, with slight grey down and close black hairs. Abdomen flattened, of a beautiful metallic blue, slightly violet. Legs of a light fawn colour. Squamæ and wings of brownish hue. From Brazil. Vienna Museum."

Fig. I.—*Dermatobia hominis* Linn. (×4).

Goudot gives the following description:—

"*C. abdomine cyaneo, basi pilis aloidis.* Length, 1 centimetre 7 millimetres (7 to 8 lines); antennæ yellow, the first joint provided at its extremity with a small tuft of short black hairs, the third joint at least as long as the other two together, arista somewhat brown, with hairs on the upper side only; eyes brown with a blackish band across the middle, front projecting, obtuse, brown, covered by blackish hairs; face and frontal depression fawn, covered by minute hairs forming a kind of down, and giving these parts a whitish silky appearance; thorax brown, shot with bluish hues, variegated with grey and black longitudinal patches, and covered with very short black hairs; scutellum the same as thorax; abdomen of a beautiful blue colour, with a shagreen appearance, and covered with very minute black hairs, first segment and anterior border of second of a dirty white, and covered with hairs of the same colour; legs fawn with fawn bristles; wings brownish. Male specimen. From Colombia."

The first binominal appellation used for this fly is that of *Œstrus hominis*, proposed, in 1781, by Linnæus, junior, who wrote: "I hope to receive from South America this summer the species of Œstrus which torments man in Peru, and of which nothing has been heard of as yet in Europe. The fly deposits on man's skin, one after another, its eggs, or, rather, its living larvæ, of which it carries about fifty on its hinder portion. The worm at once penetrates beneath and grows during half a year. If one tries to get it out by means of external ointments or by other means, it hides more deeply in the muscles, and gives rise to deadly and terrible pains. Abandoned to itself, as is the wise custom, it comes out of its own accord at the time of metamorphosis, and becomes a darkish fly, not much larger than the common house fly: *Œstrus hominis.*"

Gmelin retained this name, and in Turton's edition of the "Systema Naturæ," translated from Gmelin, we read:—

"*Œstrus hominis.* Body entirely brown. Inhabits South America. Linné ap. Pall. nord Beytr., page 157. Deposits its eggs under the skin, on the bellies of the natives; the larva, if it be disturbed, penetrates deeper and produces an ulcer, which frequently becomes fatal."

In 1822, Thomas Say gave a short description of a Dermatobia larva received from South America; he showed that this neotropical parasite is not the larva of

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Œstrus bovis, as suggested by Bracy-Clarke, and proposed the retention of Linnæus's specific designation of *hominis*, and the adoption of the generic name *Cutebra* (*sic*) by placing it in Clarke's new genus *Cuterebra*.

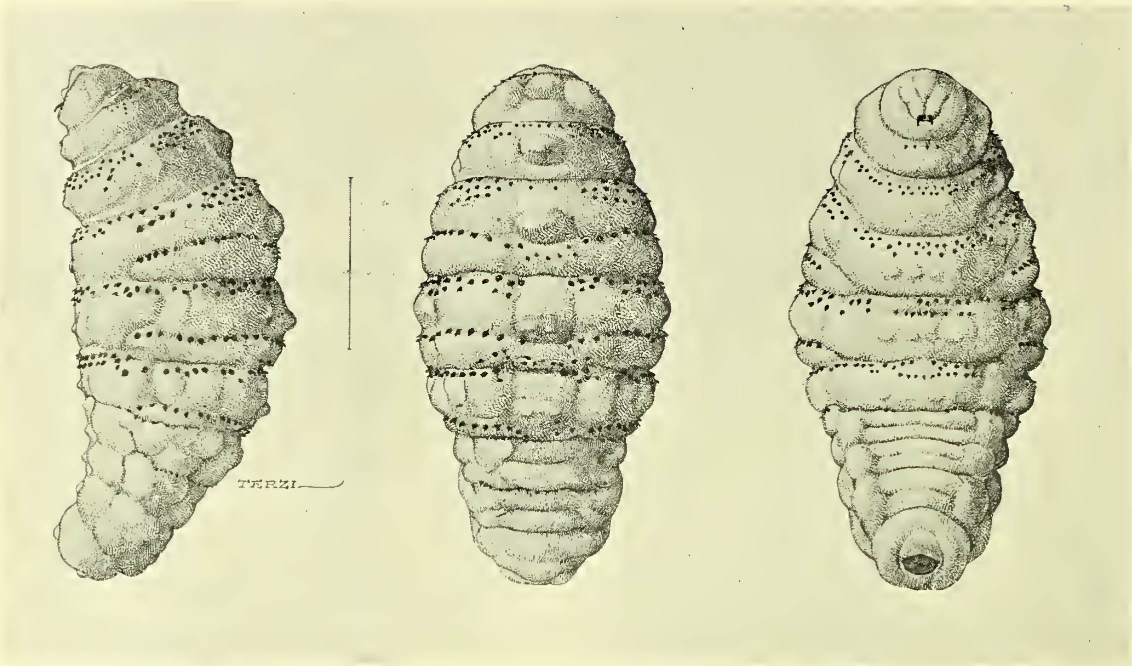

Fig. II.—Larva of *Dermatobia hominis* Linn. (×3).
(Specimen collected in Trinidad.)

In 1837, Hope, in a tabulated list of all known cases of insect larvæ found in the human body, gives the name of *Œstrus guildingii* to an Œstrid larva extracted from beneath the skin of the head of a man in the island of Trinidad, but he does not describe it, and only mentions that the specimen was in the collection of the Royal College of Surgeons, London, from where it has since disappeared.

In 1896, Dr. Serna proposed the name of *Dermatobia mexicana* for the Œstrid larvæ he had found in three patients who had contracted the myiasis in the State of Vera Cruz. According to Professor Blanchard, Serna's drawings of these larvæ do not sanction the establishment of a new species, which, he says, is entirely gratuitous.

Thus Professor Blanchard, having made a careful study of all the available data and many inquiries in various parts of Intertropical America, was led to the conclusion that between the tropical parallels there was probably only one species of Dermatobia attacking man. This conclusion was at variance with the opinion he had expressed in 1890, in his classic "Treatise of Medical Zoology," in which he said: "With the exception of Goudot, no one has ever reared any of these larvæ, therefore it would be impossible to assert that all the cases here ascribed to *Dermatobia noxialis* do really pertain to this species: on the contrary, it is more than likely that several species still unrecognized are capable of attacking man."

To this earlier impression I believe we may have to return. In fact, in the collection of Diptera belonging to the British Museum, by the side of Dermatobia specimens from Sta. Catherina, Brazil, corresponding to the descriptions of Macquart and Goudot, is another female Dermatobia, collected by Bates at Ega, on the Amazon, Brazil. This specimen is larger, its thorax is of a much lighter colour, the abdomen is more finely granulated, and, as pointed out in a manuscript note placed by the side of the specimen, by Mr. E. E. Austen, there is a slight difference in the wing venation, because, while in the other specimens the fourth vein is continued beyond the posterior transverse before turning up at an angle, in the Ega specimen the apical portion is in the same line with the posterior transverse vein.

However, in the absence of the necessary material and information, with Professor Blanchard, I am obliged for the present to consider all cases of Dermatobia

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myiasis throughout Intertropical America as belonging to a single widespread species, the synonymy of which is as follows :—

Nomenclature.

(*a*) *Scientific synonyms.*—

1781 : *Œstrus hominis* Linn. jun. (not Gmelin, 1788).
1905 : *Œstrus humanus* Humboldt and Boupland.
1822 : *Cutebra* (misprint for *Cuterebra*) *hominis* (Linn. jun.) Say.
1837 : *Œstrus guildingii* Hope.
1843 : *Dermatobia cyaniventris* Macquart.
1845 : *Cuterebra noxialis* Goudot.
1860 : *Dermatobia noxialis* (Goudot) Brauer.
1896 : *Dermatobia mexicana* Serna.
1903 : *Dermatobia hominis* (Linn. jun. 1781, not Say 1822) Ward.
1906 : *Dermatobia nonialis* (misprint for *noxialis*) Duprey.

(*b*) *Popular names.*—In most places within its distributional area the larva of *Dermatobia hominis* is simply called the "worm." Thus in Brazil, according to Da Silva Araujo, it is known by the Portuguese name of *verme* (worm) and, more frequently, *berne*, a mere corruption of the word *verme*, which is pronounced *berme* by the North Portuguese settlers.

Dr. Bleyer (1900) mentions the name "*bicheiros*" as applied to this maggot in the interior of Brazil, but no doubt erroneously, because the term *bicheiro* is used by the Brazilians to indicate the myiasis of wounds and natural cavities caused by the larva of *Chrysomyia macellaria*, called *bicho de mosca*, that is to say, fly-maggot, the word *bicho* meaning grub or insect.

In British Honduras the Dermatobia larva is called the "Beef-worm." In Colombia and Venezuela it is called either *Gusáno*,* a Spanish word meaning maggot or worm, *Gusano de monte*, which means "forest worm," *Gusano peludo*, the "hirsute worm," or *Gusano macaco*, which, like the French name of *ver macaque* in Cayenne, means the "macaw worm." This last appellation probably arose from the observed fact that *Dermatobia hominis* is a frequent parasite of the Sapajous, or Capuchin monkeys, which are called "macaw-headed" monkeys by the natives of the Amazon River basin.

In Costa Rica we find the name of *Torcel*, possibly from *torcer*, to twist, owing either to the peculiar movements of the parasite or to the twisted appearance given it by its spinulous annulation. A similar appellation has been given to the larva of *Chrysomyia macellaria*, long known in British medical literature by the name of "screw worm."

Dr. Costa (1876) states that it is called *Hura* in Brazil. In the Spanish language the term *Húra* means furuncle, but the Portuguese do not use it. It may be a native name.

Other local native names for this neotropical Œstrid are *Nuche*† (Goudot, 1845) in Colombia and Venezuela, *Colmoyote* (Morales, 1911) in Guatemala, *Cormollote* (Keyt, 1900) in British Honduras, *Mirunta* (Barraillier, 1892) in Pangoa, and *Suglacuru* (De La Condamine, 1745) amongst the Mayas.

The more common and interesting names, however, are those which indicate either the parent or the vector of the parasitic maggot. Thus, in Mexico, the appellations *Moyocuil* and *Gusano moyocuil* indicate that the "worm" is the larva of a fly, because the word *moyocuil* is taken from *moyotl*, a fly, and *ocuili*, a worm, in the Mexican language. In Colombia, Venezuela, and Guatemala the commonest name is *Gusano de Zancudo*, which means "mosquito worm," because the Spanish term *Zancudo*,‡ meaning "long-legged," is used to denote several species of Culex. Indeed, the name *Gusano de mosquito* (Logan, 1892) is also used in Colombia. In Dutch Guiana, the name is "mosquito worm," and in the island of Trinidad "mosquito

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* Dr. Brick (quoted by Say, 1822) writes *Husano*, which is only a transliteration of the word *Gusano*.

† This term has been erroneously spelt as *Ouche* (Say 1882), *Muche* (Osborn 1896), *Nuche* (Gonzales Rincones 1912).

‡ *Sancudo*, used by some authors, is a transliteration of the word *Zancudo*.

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worm" is now the usual appellation, though Father Guby, in his time, reported it to be *Ver maringouin*, which has the same meaning, because, although the name *Maringouin* (from the Indian term *Maruin*) applies more especially to marine culicoides, and to other small biting flies of the sub-family Ceratopogoninæ, it is also erroneously used to indicate Simuliidæ and mosquitoes.

Geographical Distribution.

Dermatobia hominis is a neotropical Œstrid ranging throughout Intertropical America. Within this vast area the actual stations are usually located in the wooded tracts of the coastal lowlands and river valleys. Necessary ecological features of the habitat are: a warm temperature, a certain amount of surface water, and forest vegetation.

The presence of large herds of cattle is, of course, an important element in the location, prevalence, and spread of the Œstrid, but it is by no means essential. The Dermatobia attacks man and the domesticated dog in virgin forests far removed from cattle-grazing grounds, where, obviously, local wild animals must serve as hosts for the necessarily parasitic larval stage.

A more important distributional factor is no doubt the insect associate which appears to be frequently employed by the Œstrid for the conveyance of its progeny to a suitable vertebrate host. This nurse, or carrier, is as a rule a woodland breeding mosquito of the genus Janthinosoma. So far, the few specimens with Dermatobia eggs adherent which have been properly determined belong to the species *J. lutzi*, which occurs in damp woods and shady river sides, but probably other species with a similar distribution may also be concerned.

Imported cases of cutaneous myiasis due to *Dermatobia hominis* have been observed from time to time in New Orleans and other United States towns, but so far this Œstrid has not been reported as indigenous from any part of the Union. An inquiry opened on behalf of Professor R. Blanchard, in 1895, by Drs. L. O. Howard and Ch. Wardell Stiles, proved negative.

Ward (1903), in his paper on the "Development of *Dermatobia hominis*," says: "While the habitat approaches closely to the borders of the United States, it does not appear that any evidence has been offered for its presence within our country. Blanchard emphasizes his inability to secure any such, and an extensive correspondence on my part with societies and individuals in Texas and Louisiana has been equally negative."

Dermatobia is absent from the *Mixtlan* or "Cloud land" of the ancient Aztecs, the so-called Mexican plateau made up of irregular uplands bordered by the two converging sierras. Writing to Professor R. Blanchard from Morelia, in 1893, Dr. Eugène Dugès says: "During the twenty-eight years I have lived in Central Mexico, and notwithstanding fourteen years' residence on a large estate, I have never seen any kind of larva beneath the skin of either man or domesticated animal. It is probably limited to the warm lowlands." His brother, Dr. Alfred Dugès, failed to find it in Guanajuato, and states that it is equally unknown in Mexico City. It occurs, however, in the lowlands on either side of the plateau, where extensive savannas alternate with marshy plains and dark forests infested by clouds of mosquitoes. Here, to escape their insect tormentors, the long-horned oxen will plunge into the nearest quagmire, leaving muzzle alone exposed. On this alights an associate of the bovid—a pretty little bird which lives on mosquitoes.

The occurrence of *Dermatobia hominis* in the Mexican lowlands has long been known. Already, in 1653, Father Cobo reported it from the coast district of Alvarado, in the State of Vera Cruz. According to Altamirano it is found on the Atlantic coast plain in the States of Yucatan, Campeche, Chiapas, Vera Cruz, Hidalgo, and Tamaulipas. It is found also in the inland States of San Luis Potosi, Michoagon, and Oaxaca. On the Pacific coast it occurs as far north as Elota and Cosala in the southern portion of the State f Sinaloa. From the Isthmus of Tehuantepec Major Barnard had already reported it in 1852.

As in Mexico, so in Central America, Dermatobia is absent from the mountainous country, but abounds in the low-lying coastlands. Miss Ormerod (1886), Dr. Keyt (1900), and Dr. Gann (1902) report it from the Colony of British Honduras as very common in man, dog, and ox. The well-known naturalist, Dr. Le Conte

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(quoted by Leidy, 1859), met with it during the summer of 1857, in Spanish Honduras, where he and his travelling companions became the unwilling hosts of numerous specimens. Logan (1892) saw it along the banks of the Rio Tinto. Jousseaume and Mégnin in 1884, and Folkes in 1897, reported cases from Guatemala. Dr. Zepeda, while at the London School of Tropical Medicine, in 1913, informed me that it is quite common on the Atlantic coast of Nicaragua, and Dr. Von Frantzius (quoted by Grube, 1860) states that it is very prevalent in Costa Rica. "Such cases," he says, "are so common in Costa Rica that almost every native remembers having seen some. However, the fly is limited to the low, warm, and humid regions, especially in the neighbourhood of large cattle herds. Sometimes they are also found in the primeval forest at a great distance from any cattle."

With regard to Panama, Matas (1888) says: "The importation of cases to New Orleans is not rare since the Panama Canal and other enterprises have increased the traffic between this port and the Central American Republics. I have been informed, in fact, that on one occasion quite a number of returning labourers or immigrants were admitted suffering with these parasitic larvæ."

Coming to South America we find it very prevalent in the river valleys and coastlands of Colombia, where, according to Posada Arango (1871): "there is not one single wooded locality with an average temperature above 18°C., in which cattle are not cruelly tormented by this fly," and, again, elsewhere he says: "It is not in the open pastures, but in the wooded tracts that one meets the fly that produces these worms or larvæ."

Already, in 1569, Friar Pedro Simon reported it from the selvas and savannas along the banks of the Rio Magdalena, and from the low plains to the east of the Andes. More than three centuries later, Logan (1892) again reported it from the Magdalena near Mompos, and from the selvas of the Sinu basin. During nineteen years' experience in tropical forests, Logan estimates that he fostered at least one hundred Dermatobia larvæ in different parts of his body. At one time he had eighteen of the maggots squeezed out of his back. He had been for weeks hunting mahogany, and there were neither cattle nor people anywhere around. Cattle were likewise absent from the locality on the Sinu river. Goudot (1845) says:—

> "It is unknown in the pastures of the cold regions, whilst in the temperate and warm regions of the lowlands it is only found on the borders of the great forests and in the *rastrojos,* that is to say, in those places presenting together both woods and prairies. In such places they swarm exceedingly, especially when prolonged rains have prevented the burning of the prairies; therefore such localities are not considered very suitable for the rearing of cattle. However, when driven thither, one may see these animals spend a great part of the day in sandy and arid areas rather than seek the shade and pasturage of places where the enemy lurks in force. I have seen them at times galloping off frenziedly across the plains, probably on account of the sufferings inflicted by the aggregation of so great a number of cauters. It is especially in the afternoon that I have observed this fact."

Goudot found this Œstrid also in the valley of the Cauca, in rich grazing lands adjoining a salt pit, where horses and mules fattened rapidly, but where horned cattle were never pastured on account of the Dermatobia. In this place dogs were dreadfully riddled on all parts of the body, and men were also affected. Dr. Erasmus Baños tells me that it is very prevalent in the valley of the San Jorge. Forel (quoted by Blanchard, 1896) states that he contracted this form of myiasis in the forests on the northern slopes of the Sierra Nevada of Santa Marta, and Houship (1833) reported a case from Santa Ana in the Mariquita region.

Also, in Venezuela the Dermatobia is very common, especially in the low valleys of the coast and all along the forest-backed grazing belt. Dr. Brick's case (quoted by Say, 1822) was contracted on the Chama, a stream which empties itself in the lagoon of Maracaibo. Dr. Félix R. Páez informs me that it is especially prevalent in the cattle-rearing llanos of Guarico and Barcelona, but he has seen the maggot in patients who had contracted it in the virgin forests of Guayana, south of the Orinoco, where there are no cattle. He says that, according to cattle-breeders, the Dermatobia seems to have spread considerably, in recent years, from west to east.

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Together with Venezuela, it is necessary to consider the islands lying in proximity to its coast, because, though some of them are usually grouped with the Antilles, they are of different geological formation and separated by great oceanic depths. Unfortunately, we have no reliable information concerning the presence or absence of Dermatobia on the majority of these islands. Some may at once be discarded either because they are only reefs, or because they do not offer those ecological conditions which are essential to the Œstrid. But others, such as Trinidad and Tobago, appear to be most suitable, and, indeed, the island of Trinidad has long been known as a Dermatobia centre. This island is obviously a mere fragment detached from the Venezuelan region by some comparatively recent disturbance. The geological formations in the island and on the mainland are everywhere the same, and numerous examples show that the Trinidad fauna belongs to continental South America and differs from that of the Antilles proper. Thus, for instance, of the large genus Thamnophilus of the ant-birds (Formicariidæ) at least three species occur in Trinidad, and one is found in Tobago, but no member of the family is found in the other Antilles.

In 1858, Dr. Shaw stated that according to Dr. Weinland, of Cambridge, U.S.A., the *ver macaque* is common in Guadeloupe, but this is a mistake, due, no doubt, to confusion with the myiasis caused by *Chrysomyia macellaria. Dermatobia hominis* is unknown in Jamaica, Antigua, Montserrat, Dominica, St. Lucia, St. Vincent, Barbados, Grenada, and, I believe, from all the Leeward and Windward Islands, as well as from the Greater Antilles. The cases reported from Martinique, by Guyon in 1835, came from Trinidad.

In 1837, Hope described a larval specimen of Dermatobia from Trinidad, and proposed that it should be called *Œstrus guildingi.* This specimen is no longer at the Royal College of Surgeons, where it had been deposited, but there can be no doubt that it belonged to *Dermatobia hominis,* the only species at present known in the island. In 1895, Mr. E. E. Austen, dipterologist to the British Museum, had the opportunity of examining a specimen from Trinidad and referred it to this species. *Dermatobia hominis* is well-known in this island, where it attacks both man and animals. It is especially prevalent in the eastern and south-eastern districts. Already, in 1902, Dr. A. J. B. Duprey had drawn attention to its frequency in Mayaro, where there are still extensive tracts of primeval forest. I have seen cases in the north-western portion of Trinidad, and Dr. E. N. Darwent told me he had seen many in Chaguanas amongst convicts engaged in clearing forest land. De Verteuil mentions it in his book on "Trinidad" published in 1881.

In the Guianas both surface conditions and climate resemble those of Venezuela, and Dermatobia is equally prevalent. Hill (1830), Ormerod (1886), Daniels and Conjers reported it from British Guiana, Houship (1833) and Wyman (quoted by Shaw, 1858) from Surinam or Dutch Guiana. Houship's patient contracted the parasite on the banks of the Maroni or Marowyne. From Cayenne or French Guiana it has been reported by De La Condamine (1745), Arture (1757), Guyon (1835), Coquerel (1859), Laboulbène and Davaine (1860), Bonnet (1870), and others. The majority of the patients had been affected whilst working in the great lowland forests. Guyon's case, seen in the island of Martinique, had come from near the mouth of the Mana river.

In Brazil, *Dermatobia hominis* is widely spread and very common. According to Costa (1876) it is especially prevalent in the damp lowlands of the provinces of Bahia, Minas-Geraes, and Rio de Janeiro. Bates (1863) reports it from the Upper Amazon, and a specimen in the Madrid Museum was extracted from the thigh of Jimenez de la Espada, a Spanish zoologist, who explored the Amazon and the Rio Napo in 1862-65. Da Silva Araujo (quoted by Blanchard, 1893) reports it from the States of Goyaz and Espirito Santo and from the neighbourhood of Rio de Janeiro. Dr. Bleyer (1900) states that it is frequent in the interior of Brazil. Dr. Abreu (1854) observed it in the State of Minas Geraes, and especially in the district of the Rio das Velhas, where it occurs frequently both in man and cattle. Dr. Magalhães (1896) reports it from Guaratingueta to the north of Sao Paulo, and numerous specimens, such as those of Torre and Sangalli (mentioned by Blanchard, 1893), have been extracted from time to time in Italy from Italian labourers returning from the State of Sao Paulo.

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For Bolivia we have no records, but the British Museum possess a Dermatobia larva from the valley of the Madre de Dios.

With regard to Paraguay, Argentina, Chili, and Ecuador, so far as I know, we have no information whatever. Therefore, the last country to be mentioned is Peru, where the Dermatobia is known to prevail extensively in the humid forest-covered lowland of the Amazon valley. Barraillier (1892) reports it from the basin of the Pangoa, a river which flows into the Ucayali, itself a tributary of the Maranon. Austen (1895) describes a specimen in the British Museum, which was taken from Mr. E. Bartlett's arm in Chamicuros. It is also found to the west of the great chain of the Cordilleras, whence C. Linnæus, junior, had reported it as early as 1781.

Zoological Distribution.

Besides man the vertebrates most frequently observed to be affected by the larvæ of *Dermatobia hominis* are oxen and dogs. Both these animals suffer severely within the fly stations. Goudot states that in certain parts of Colombia, during favourable years, the warbles may be counted by hundreds on the head, back, and flanks of cattle, and it is well known that the "Rio hides" are so greatly damaged by the Dermatobia that they are of little commercial value.

According to Goudot, Posada Arango, and Da Silva Araujo, horses are entirely exempt, but Arture mentions the horse as a host, and Roulin in his "*Récherches sur quelques changements observés dans les animaux domestiques, transportés de l'ancien dans le nouveau continent*," says that in Colombia, from time to time, the horses are collected to rid them of Œstrid larvæ. In Europe, the ox warble (*Hypoderma bovis*) is known to attack the horse, and Vallisneri pointed it out at the beginning of the eighteenth century. Mules are certainly not immune. Coquerel extracted a Dermatobia larva from the back of a mule in French Guiana, and Dr. J. Bleyer (1900) states that the maggot is well known in Guatemala to the "tropeiros" (leaders of mule caravans), who "for the relief of their animals use undiluted creolin, introducing the same by means of small feathers into the swelling containing the larva; after the expulsion of the parasite the cavity is closed with clay or fresh dung. The 'fazendeiros' (land owners) use the same method in the camp districts to free the cattle of the warble-fly larvæ." However, it is possible that there may have been confusion at times between *Dermatobia hominis* and *Chrysomyia macellaria*. Dr. Eduardo Bárcenas tells me that an immunity just as remarkable as that of the horse is observed in the white cattle of the district of Antioquia, in Colombia. These forest cattle have a white coat and black ears, like the British park cattle and the cattle which have run wild in the Falkland and Ladrone Islands. They are believed to have descended from the ancient aurochs, and were probably the first cattle introduced from Spain into South America. Their immunity is no doubt an acquired immunity. Even man may acquire a certain degree of immunity. Logan (1892) tells us "the naked Indians had not one-tenth as many larvæ as whites, who wore shirts."

Of other domesticated animals the hog, the goat, the sheep, and the cat are frequently attacked.

All these domesticated animals were first introduced into tropical America by Europeans at the beginning of the sixteenth century; therefore, notwithstanding the great importance acquired by some of them as hosts and reservoirs of the parasite, we must look to the indigenous wild fauna for the original and normal hosts.

The larva of *Dermatobia hominis* has already been found in various animals belonging to the fauna of the neotropical region. Thus, several authors point out that it is a somewhat common parasite of monkeys—Carriker found it in a large reddish Sapajou or Capuchin monkey (*Cebus sp.*), about one individual in thirty being infected. Bates reported it from the Brown Howler (*Mycetus ursinus*). Roulin found it in the Jaguar (*Felis onca*), Williston mentions the Puma (*Felis concolor*) and the Red brocket (*Cariacus rufus*), and Bonnet states that it occurs in the Agoutis (*Dasyprocta*). It affects also birds. Guyon says that the large larvæ are found in the warty skin that covers the head and neck of the turkey (*Meleagris sp.*). Carriker found it on the Doubtful Toucan (*Ramphastos tocard*) of Colombia, and on ant-birds (Formicariinæ). In Trinidad I was told that the "mosquito worm"

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is also found in the domestic fowl, but an infested chicken shown me at the Arima District Hospital proved to harbour the larvæ of *Mydœa pici* (Macquart), a dipterous parasite of the family *Anthomyiidœ* which occurs very frequently in the nestlings of South American birds. However, with regard to the maggots found by Carriker in the Toucan there can be no doubt, because they were examined by a most distinguished parasitologist, Dr. Henry B. Ward, who found them to be specimens of *Dermatobia hominis*.

Our knowledge of the zoological distribution of *Dermatobia hominis* is very imperfect, and the little we know is by no means recent, for already Arture, in 1757, had stated that its larval stage occurred somewhat frequently in monkeys, and was also found in horses, dogs, cats, birds, and man.

Season.

On account of the well-known seasonal differences between temperate and tropical regions, the life-cycle of the neotropical *Dermatobia hominis* is unlikely to be as markedly periodic as that of the Holarctic Œstrids. However, the necessity of some kind of periodicity is indicated by the fact that conveyance of the hatching larva to the necessary vertebrate host is brought about usually, if not invariably, by a mosquito intermediary, the presence of which is dependent on certain seasonal conditions. Folkes (1897) says that the natives of Guatemala claim the "gusano" to be most frequent during the rainy season, but that from his personal experience he believes it to be most numerous just subsequent to the rainfall, and Goudot (1845), who studied the bionomics of this Œstrid in Colombia, states that it is particularly prevalent after protracted rainy seasons. Dr. Páez tells me that, whilst in the llanos its prevalence is greater during and after the rains, in the selvas it is more or less the same all the year round. This is exactly what we should expect in view of its peculiar mode of transmission, and is itself an element in support of the reality of the culicid association. Of course, the rainfall varies greatly in distribution, season, and amount throughout intertropical America, and no doubt the incidence of the disease will be found to vary from place to place in accordance with the respective local meteorological conditions. However, in a general way, we may state that the Dermatobia warbles have been noticed to occur in man and cattle chiefly from March to September, with a greater prevalence in the months of April, June, and July, and this period corresponds more or less with the rainy season of the fly areas in Mexico, Central America, Venezuela, Trinidad, Colombia, the Guianas, and Peru, whence the scanty records come.

Anatomical Distribution.

In cattle the Dermatobia warbles may be found on the head, the sides, the tail, and all along the backbone, but it is principally about the shoulders that they are most numerous. As Goudot points out, they seem to select the parts inaccessible to the animal's tongue, horns or tail. Also in other animals the back and the shoulders appear to be the parts preferred, but they may be found in any part of the body; thus in man they have been seen on the scalp (Posada Arango, Urich) and on the face. Grube extracted one from the tip of the nose. Keyt and Posada Arango have seen them several times in the eye socket, Magalhães in the eyelids, Logan on the upper lip. They occur in the neck region, on the chest, in the armpits, on the abdominal walls, on the buttocks, in the intergluteal furrow. The scrotum is a frequent site, and Dr. Bleyer saw one on the vulva. The extremities are very frequently attacked, especially the arm, the leg, and the thigh. Costa has seen them on the fingers, Da Silva Araujo (1893) saw one on the heel.

According to the majority of authors the warbles appear as a rule on those parts of the body which are usually uncovered. Bonnet suggests that the location of the warbles may be due to the larva's preference for those parts in which the skin is thickest and the cellular tissue more abundant. To explain the presence of larvæ in parts of the body usually clothed, infestation during sleep, bathing or defecation has been suggested. It is quite possible, however, that, as in the case of Hypoderma, some of the Dermatobia larvæ may be ingested, penetrate the walls of the *primœ viœ* and actively migrate to suitable locations. This would explain

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the appearance of warbles in such parts as the inner canthus of the eye (cases described by Gann, 1902, Keyt, 1900, Posada Arango, 1871), and the progression of the maggot beneath the skin noticed by Dr. Brick (quoted by Say, 1822) and by one of the patients I had the opportunity of examining in Trinidad. On the other hand, Da Silva Araujo (Blanchard, 1893) saw a dog with thirty-two Dermatobia warbles, all on the same side of the body, and Dr. Magalhães (Blanchard, 1896) mentions the case of an eight-months' old child, on whose head were eleven Bernes, all on the same side, suggesting development *in situ*.

Infestation.

For a long time entomologists and physicians, guided almost entirely by what was known of other Œstrids, assumed that the female *Dermatobia hominis* deposits its ova or very young larvæ directly upon the skin of man and animals. Some affirmed without hesitation that the fly "stings" during the act of oviposition. Arture (1757) wrote that apparently it places its eggs beneath the skin by means of some boring organ which enables it to pierce through the hide, and added that it attacked its victims only when it found them asleep. The piercing notion is, of course, erroneous, as the Dermatobia has no piercing apparatus, either at the oral or the anal end.

The great majority of reliable and observant patients state that they never saw or felt any fly and that they became aware of the parasite only after it had attained a certain development. Thus an entomologist, Mr. Forel, says: "I have had the pleasure of being punctured by an Œstrid without being aware of it." And another naturalist, Dr. Le Conte, asserts that neither he nor his travelling companions were aware of the time when the Dermatobia eggs were deposited in their bodies. During the whole of his stay in Honduras, Dr. Le Conte never had the opportunity of observing a single specimen of the perfect insect.

Bonnet (1870) says:—

> "The attacks of the insect occur unperceived. The majority of patients come from the great forests in which they work. Not one has ever been able to furnish any information as to the beginning of the affection nor state when he was attacked by a fly."

Guyon (1835), in describing a case, says:—

> "Such was the ignorance of this sailor that, when asked whether he had been pricked by some insect, he answered at once in the negative. On my insisting upon the question, he added, 'with the exception of mosquitoes and sand flies which every evening infested the village.'"

Goudot (1845), who made a special study of the bionomics of *Dermatobia hominis* in Colombia, says:—

> "Notwithstanding the most scrupulous attention, I have never been able to see or hear the insect as it came flying to me to deposit its ova on the uncovered parts of the body. And when I stated above that one sees cattle refrain at times from pasturing, I did not intend to convey the idea that they are molested by this dipterous insect more than by any other; on the contrary it is very probable that they are troubled far more by Culicids, Tabanids, and Muscids."

Toussaint (*vide* Blanchard, 1896), Curator of the Pathological Museum at the S. Andrea Hospital, Mexico City, having made a histological study of the Dermatobia warble, came to the conclusion that the fly must deposit its ova on the skin and hairs, and that, soon after hatching, the larvæ penetrate into the hair-follicles, which become greatly distended owing to the growth of the parasites. This conjecture is erroneous, as the strong fibrous capsules which enclose the larval Œstrids are not formed by distended and hypertrophied hair-follicles.

However, direct oviposition cannot be entirely excluded. Dr. Lutz, whose great competence and accuracy are well known, has assured me that not infrequently *Dermatobia hominis* is seen either hovering round horses and men or perched on cattle. At times he has observed it flying round cattle with ovipositor typically exserted and ready to oviposit.

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Dr. Brick (*vide* Say, 1822) states that in Venezuela some of the Spaniards and Creoles believe that the Dermatobia larva "crawls on the body from the ground, and penetrating the skin increases in size." Thus, according to Roubaud, acts the larva of *Cordylobia anthropophaga* (E. Blanchard), an African Muscid, which, in man and animals, produces furuncular swellings exactly like those of the American Œstrid.

Barraillier (1892) says that, according to the observations of a friend who had resided for some months in Pangoa, this myiasis is brought about through leaving the washing out on the line after sunset. "At that time numerous flies come forth and settle on the clothes put out to dry. On these they oviposit and then fly away, leaving behind the seed of certain worms which, hatched by the heat of the body, at once penetrate through the pores of the skin and then reach the part most suitable to their development."

A belief very widely spread throughout the distributional area of *Dermatobia hominis* is that the fly oviposts upon the leaves and stems of plants. Da Silva Araujo (quoted by Blanchard, 1893) says:—

> "I have frequently heard the peasants state that the fly of the *Berne* likes to oviposit on those plants which are at the edge of a path, and that both man and animals may contract the affection whilst sweeping by the plants, the leaves of which bear the eggs of the Œstrid. The narrowing of paths in the country would explain such a method of infestation."

Major Barnard (1852) says that, according to the natives of the Isthmus of Tehuantepec, "the *Moyoquil* is commonly found on the leaves of a species of wild plantain growing in the country." Dr. Surcouf (1913) also states that, according to information received from Dr. Gonzales Rincones, the fly oviposits on leaves in damp localities.

It is only quite recently that physicians and entomologists have begun to apprehend and to endeavour to ascertain the reality of the extraordinary procedure by means of which *Dermatobia hominis* insures the safe arrival of its progeny to suitable hosts, but the people living within the distributional areas of the fly have known it from time immemorial. They learnt it by the simple, rational, and unerring process of repeated observation and experience, which led the natives of south-east Africa to incriminate the tsetse fly as the transmitting agent of trypanosoma infection (nagana) in horses, the Texas farmers to discover that cattle babesiasis (Texas or red-water fever) is conveyed by ticks, and the inhabitants of malarious regions in many parts of the world to recognize the mosquito as the inoculator of ague.

The Jesuit, Father Bernabé Cobo, in his *Historia del Nuevo Mundo*, written in 1653, says:—

> "In some of the warm lowlands there is a species of mosquito which undoubtedly is the most noxious. It resembles the Zancudo (common mosquito), but its colour is somewhat reddish. In each wound produced by this mosquito soon grows within the flesh a spine-covered worm the size of a haricot bean, or even larger, which must be removed by means of a needle in the same way as the Niguas (*Sarcopsylla penetrans*)."

In 1745 De La Condamine, speaking of the "ver macaque," says:—

> "It is stated to take birth in the wound made by a kind of mosquito or sand-fly, but, so far, the animal which actually lays the egg is unknown."

In 1781, Linnæus, junior, although he does not mention the mosquito and even speaks of the Œstrid as ovipositing directly on man, yet describes the peculiar arrangement of the eggs in a bundle attached to the abdominal segments which is observed not on the fly which deposits the eggs, but on the Culicid carrier, and of which he must have been informed by local observers. He says:—

> "The fly deposits on man's skin one after another its eggs, or rather its living larvæ, *of which it carries about fifty on its hinder portion.* The worm at once penetrates beneath and grows during half a year."

In 1822, Say published a letter received from Dr. Brick, in which it is stated that:—

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"Whilst some Spaniards and Creoles believe the *Ouche* to be produced by a worm which crawls on the body from the ground, others maintain that they are produced from the sting of a winged insect which they call *Zancudo* (word used by the South American Spaniards to denote several species of Culex)."

In 1884, De Verteuil, in his book on Trinidad, speaking of injurious insects, says:—

"The Œstrus deposits its larvæ in the bodies of animals, and even of human beings. It is known here by the name of *Ver-maringouin* or *Mosquito-worm,* the people being under the impression that the larva is that of a large mosquito; but the fact is that no one here has ever seen the mother-insect."

In 1892, a naturalist, Mr. David Logan, who had spent nineteen years in the forest regions of Honduras and Colombia, also reports that the natives of those countries believe that the Dermatobia grubs are produced by a species of yellow mosquito.

These and many other similar statements in the vast literature of travel, together with some of the old and widespread popular names of the parasite, such as *Gusano de Zancudo, Gusano de Mosquito, ver maringouin,* and *mosquito worm* and the very general assertion that it is contracted at night during sleep prove that, from a remote time, the belief in the necessary association between *Dermatobia hominis* and a special kind of mosquito was widely prevalent throughout the range of this neotropical Œstrid. Yet, until quite recently, we find the popular notion either disbelieved or unheeded by the man of science, just as in the case of the relationship between ticks and cattle hæmoglobinuric fever prior to the epoch-making investigations of Smith and Kilborne.

In 1893, Da Silva Araujo, writing to Professor R. Blanchard, says:—

"It is a widely spread belief in our lands to ascribe the Berne to a mosquito. Already, in Colonial days, Dr. Alexandro Ferreira ascribed the Berne to the Carapaná mosquito, which is very common on the banks of the Amazon. Again, quite recently, I have had the opportunity of ascertaining how very common this error is amongst our peasantry. I inquired about the Berne and its imago stage from a forester inhabiting the State of Espirito Santo. Would you believe it, notwithstanding all my efforts to convince him that the perfect insect presents the features of a fly, he obstinately persisted in assuring me that I was wrong and that the Berne arises from a large mosquito? No wonder, therefore, that mosquitoes have been sent to you as progenitors of the Berne. It is a popular error, very widely spread throughout Brazil."

In 1897, Dr. H. M. Folkes, writing from Panyas, Guatemala, says:—

"The 'gusano sancudo' is a most interesting member of the insect species, not so much on its own account as on that of its work. The usual habitat is on dead trees and decayed vegetable matter in the woods. When found, it presents the body of a mosquito, having a longer head, with wavy greyish lines running down its back, legs longer than those of the ordinary mosquito, the two hind ones being quite stout. When preparing to do business, it settles upon the skin, inserts its bill, draws a little serum towards the surface, and then with a quick movement brings the tail to the point of insertion, puts it into the orifice, using the bill as a guide, and then rears upon its hind legs to insure a certain deposit of eggs. Immediately after the departure of the mosquito, gentle squeezing will produce a drop of serum from the infected point, and thus preclude the resulting worm."

In December, 1911, Dr. Rafael Morales, of Guatemala, published in the newspaper *El Nacional,* an article entitled "An observation on the manner in which the Colmoyote (*Dermatobia noxialis*) is transmitted to man—Transmission of the larvæ of the Colmoyote by means of the mosquito." In this article he states that, whilst studying the Culicidæ of Guatemala, on 2nd August, 1911, from a friend in Quirigua, he received a collection of mosquitoes of about a hundred specimens belonging chiefly to the genus Culex. Together with these, but in a separate box, was

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another specimen of the same genus with the following label: "Mosquito carrier of Colmoyctes (*Dermatobia noxialis, Cuterebra noxialis.*)" On examining this curious specimen he noticed eight elliptical eggs about 2mm. long, of a yellowish-white colour with anterior extremities blackish. They were attached by their posterior extremities to the mosquito's abdomen between its junction with the metathorax and the fourth segment. Two of them still contained a living larva, the others were empty. On the sixth day of observation, on placing the mosquito in the palm of the hand, one of the larvæ escaped from its shell. Dr. Morales' attendant, Macario Cruz, having offered himself for the rearing of the larva, the latter was placed on the anterior surface of his forearm. The larva wandered about over the whole of this region, as if it were searching for a suitable place in which to introduce itself. To favour its penetration the epidermis was slightly abraded and the larva at once began to burrow, pointed end foremost, and soon disappeared. Five days later the patient began to feel some itching and pricking. A swelling had already formed, presenting the appearance of a medium sized comedo with a small opening at the apex, from which, on pressure, oozed out a tiny drop of milk-white matter.

On the 18th, the swelling looked like a true furuncle, the hole at the top had become wider and through it one could distinguish a small appendix (the posterior extremity of the larva). The patient complained of severe itching, and at times, especially during the night, of sharp pains whenever the grub moved within the swelling.

"On the 25th," says Dr. Morales, "we took the patient to the house of Don J. J. Rodriguez, to whom we had already shown the Culex carrier. This eminent naturalist sent for Dr. R. Pacheco Luna, recently back from Paris, who encouraged us to continue our observation.

"In the first days of September we showed both the patient and the mosquito to Dr. Alberto Padilla, Professor of Parasitology at the Medical Faculty. He told us that he had never heard of anything so strange, and that he considered the observation should be continued in the most careful manner.

"On the 9th of September the swelling had assumed somewhat the appearance of a carbuncle, new holes having opened around the primitive one.

"In this condition the patient stated that the pain had increased, owing, he said, to the movements of the larva which became more numerous and more powerful. He now repeatedly asked for the extraction of the parasite.

"On the morning of the 15th the limb was greatly swollen and presented marked lymphangitis. Fearing the development of a phlegmonous cellulitis we proceeded as follows:—With a short scalpel we enlarged the opening through which appeared the caudal extremity, then by means of compression made with the thumbs from the base upwards the larva was extracted. It measured one centimetre in length, was pear-shaped, yellowish-white, and contractile. It had two strong hooks on the upper part of the rostrum and six rows of hooklets on the borders of the segments round the wider part of the body. These hooklets greatly resembled rose thorns, and their concavity was turned posteriorly, thus enabling the larva to advance through the deeper parts of the integuments but not regress. Hence the difficulty of extraction without enlarging the opening or previously killing the larva. (The latter method is the one employed by the natives, who for the purpose apply tobacco.)

"Four hours after extraction the larva was transplanted into the back of a rabbit, and here it continued its development perfectly well.

"On the 1st of October we noticed a change in the position of the larva. Instead of lying perpendicular to the skin it had placed itself parallel to it. The pear-like form could be made out by the touch; also one noticed that the part of the skin corresponding to the cephalic region was red. This enabled us to guess the formation of a new opening.

"In fact, on the morning of the 2nd the opening had been made, but the swelling had disappeared. The larva had escaped. Once nymphosis has begun the larva prepares itself an outlet in order to leave its host.

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"Thus, unfortunately, our observation came to an end. The study of the characters of the larva enable us to affirm categorically that it really belonged to *Dermatobia noxialis.*

"How explain that the Culex was the carrier of the eggs? Undoubtedly the Dermatobia seeks the Culex to deposit its eggs upon it, and the latter undertakes not only to distribute them but also to open for them an entrance through the skin by means of its puncture.

"This method of transmission explains why the peasants do not know the adult fly and also why they do not know how the larva can reach those parts which are usually covered during the daytime.

"According to the present observation the larval period would be of two months' duration (from 8th August to 2nd October). However, a doubt arises as to whether the transplantation into the rabbit might not have had some influence either in retarding or forcing the development. Further experiments will tell us."

Two months earlier, on the 1st of October, 1911, Dr. Nunez Tovar, of Maturin, Venezuela, had wired to Drs. Razetti and Guevara Rojas, of Caracas, the following message:—

> "Sending specimen mosquito I consider animate vehicle which deposits on skin, man, and animals, fly larvæ *Dermatobia cyaniventris.* Transports eggs exteriorly attached to abdomen where they transform themselves into larvæ to pass thence to the skin of man and of animals by intermediary mosquito. Please tell me whether this fact has antecedents in parasitology. Colleague and friend, M. Nunez Tovar."

Dr. Guevara Rojas, having received the specimen, replied on 11th December, 1911, that owing to its great interest he had decided to submit it to Professor Blanchard, and that in due time he would communicate the latter's remarks.

Meanwhile, Dr. Nunez Tovar sent other specimens to Dr. J. M. Romero Sierra, of Caracas, and in the covering letter, dated 24th October, 1911, pointed out that:—

> "The said mosquito has attached to the abdomen a bundle of whitish eggs perfectly visible under a slight magnification. These transform into larvæ which at once adhere to the gnat's body (by preference, about the insertion of the hind pair of legs) and here they remain in the hope that their transporting agent may soon come into contact with the skin of either man or animal, in order that they may penetrate into the subcutaneous cellular tissue, the which medium, as you know, is indispensable in bringing to a successful issue the second part of their developmental cycle."

On 13th May, 1912, in a short note published in the "*Archives de Parasitologie,*" Professor Blanchard stated that he had examined Dr. Nunez Tovar's specimen, but that, owing to bad preservation, he could only say that it was a female Culicid. On the ventral surface of the abdomen were a certain number of eggs agglutinated and arranged after the fashion of Tabanid eggs. The larvæ contained in these eggs certainly belonged to the Brachycerous Diptera, but he doubted whether they could be ascribed to an Œstrid. So little was known of the general characters of the larvæ of Diptera that, in the absence of experimental rearing through the various stages, it would be impossible to state to what family, still less to what genus, they might belong.

On 4th December, 1913, Dr. R. Gonzales Rincones published in the newspaper *El Universal,* of Caracas, an interesting article on the subject, entitled "The Aeroplane of the Macaw-worm." He stated that we owed to Dr. Nunez Tovar the discovery of the extraordinary method of transport by means of which the macaw-worm reaches its mammalian host. "The maggot travels by aeroplane!" and the aeroplane is a mosquito. Having received from Dr. Nunez a whole collection of mosquitoes with Dermatobia eggs attached, Dr. Gonzales Rincones was able to determine that the Culicid carrier is a Janthinosoma, and, further, that it is always a female Janthinosoma. So far, Dr. Nunez Tovar has never captured a single male engaged in this peculiar mode of transport. The eggs are found in clusters and are attached by their more pointed extremities to the ventral surface of the first two abdominal segments of the female gnat. In one cluster he counted as many as

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seventeen eggs. The larvæ escape through a slit which opens at the wider extremity of the egg-shell corresponding to the cephalic region of the larva. At times, the hatching larvæ may be seen protruding the anterior part of the body from the open shell ready to fix themselves on to the first suitable host upon which their mosquito carrier may happen to alight.

Dr. Gonzales Rincones states that Dr. Nunez Tovar experimentally reared the larvæ taken from the abdomen of their Janthinosoma carriers and obtained the characteristic furuncular swellings, from which, after eleven days, he recovered maggots identical with the well-known "macaw maggots," thus proving that the ova carried by the mosquito are really those of *Dermatobia hominis*.

In a note published in 1913, in the "Revue de Médecine et d'Hygiène Tropicales," Dr. Pedro Zepeda states that the natives of the Atlantic coast of Nicaragua speak of a mosquito which, by means of its puncture, inoculates beneath the skin "larvæ of various dimensions and shape." Towards the middle of 1911, while collecting mosquitoes, he found that two of the captured gnats presented small white protuberances scattered over the femora, prothorax, and antennæ. He asserts that two men on whom he had fed these mosquitoes developed the characteristic Dermatobia warbles in the course of a few hours! Indeed, describing his second case, he says the man "was stung on the right hand; two hours later the first symptoms appeared, characterized by itching; forty-eight hours afterwards the tumour was completely developed and there was some pain without febrile reaction; seven days later the larva dropped out." So rapid a period of development is not in accordance with our knowledge of Dermatobia infection, and suggests a possible confusion with the larvæ of some Muscid. An examination of the gnats, which belonged to the subfamily *Culicinæ,* showed that the white protuberances already observed were the larvæ and ova of *Dermatobia cyaniventris*, and Dr. Zepeda says he saw some of these larvæ "detach themselves from the body of the mosquito during the latter's movements while blood-sucking. As soon as they reached the skin, with admirable instinct they made straight for the wounded point. The anæsthetic and irritant action of the mosquito's saliva prevents one feeling the penetration of the larva, which enters the channel head foremost and disappears within the body."

In one of his subsequent experimental cases, Dr. Zepeda found a swelling presenting two openings. The parasite extracted from this tumour four days after inoculation differed so strikingly from those of the previous cases that he sent it to Philadelphia, where it was determined as a larval specimen of *Chrysomyia macellaria*. On account of this finding, Dr. Zepeda was led to believe that the larvæ of *Chrysomyia macellaria* might also be carried by mosquitoes, and further suggests that the larvæ of *Cordylobia anthropophaga* (Em. Blanchard), and Lund's maggot (*Cordylobia rodhaini*, Gedoelst) may be conveyed in a similar manner.

As early as 1905, Mr. F. W. Urich had discovered in the island of Trinidad two Janthinosoma mosquitoes with fly-eggs attached to their abdomens.

Mr. Frederick Knab (1913) says :—

> "These mosquitoes were sent to the Bureau of Entomology in Washington at the time, but no satisfactory explanation was offered, nor was their significance suspected. Unfortunately the specimens cannot now be found."

Having received from Dr. Gonzales Rincones some mosquitoes with Dermatobia eggs adherent, Dr. Jacques Surcouf (1913) was able to study the Œstrid larva in its earliest stage. He says :—

> "The greatly elongate eggs, clustered in a close bundle, are of a very pale yellow colour : close to the micropyle is a small unciform shutter (*volet*) which enables the larva to escape. The latter presents ventrally on the last two segments some short pale spines directed anteriorly; it is by means of these spines that the larva can hold itself protruding from the shell awaiting the favourable moment when it may leave the mosquito carrier and fix itself on to the new host.
>
> "In this first stage of development the larva, consisting of twelve segments, is provided with antennæ, each having two ocelli-form spots at their base. The mouth parts are formed by two chitinous plates, widened and many-branched on the lateral borders, attached to another plate, armed

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with two pairs of hooks of which the exterior ones are bifid, the inner ones simple and articulated with the pharynx. This organ, strongly chitinised and prolonged as far as the fourth segment, is not, in this stage of development, continued by any kind of differentiated digestive apparatus. The external tegument of the young larva is covered by numerous small spines on the first seven segments; the fifth, sixth and seventh segments present at the anterior border a crown of large black spines of rose-thorn shape. On the last segment open the two posterior stigmata, each one composed of two slits; so far there are no anterior stigmata. As soon as the larva has fixed itself it penetrates beneath the skin and there transforms itself. After this ecdysis the posterior spines, which held the larva within the egg-case, disappear, and the posterior stigmatic slits become three in number for each stigma.

"The further development of the Dermatobia larva is known. We wish to point out however, that, between the larvæ already belonging to the collections of the Paris Museum and those recently sent over from Venezuela, there are important differences in the spinulation. This leads us to believe that there may be several closely allied species hitherto confounded. Only complete rearing will elucidate the problem."

Having reviewed practically the whole of the literature concerning the manner in which man and animals become infested with the Dermatobia larvæ, and having taken due notice of the most recent knowledge concerning the bionomics of other Œstrids, we are in a position to form a more or less reasonable opinion on the matter.

In the first place, we should not forget that as a rule Dame Nature employs several ways, not one only, to attain important ends. In the case of *Hypoderma lineata*, for instance, we know that the young Œstrid larvæ are licked up by cattle from off the hairs round their hoofs. We know that they bore their way through the walls of the œsophagus and proceed along connective tissue roads to within the spinal canal, where they remain quiescent for a time, to migrate once again at the right season to a seat of predilection beneath the skin of the back, where they go through rapid development and finally leave the host for pupation. But, while many follow this route, others penetrate the skin at the very place where they were deposited, and then either migrate to other parts or develop *in situ*.

It is quite probable, as Dr. Lutz has pointed out, that *Dermatobia hominis* may, at times, oviposit directly on man or animals, and that the young larva may forthwith proceed to bore through the skin by means of its oral hooks, as is often the case with the larvæ of *Hypoderma bovis* and *Hypoderma lineata*.

With regard to the very general belief that the Dermatobia oviposits on foliage, I see no reason against it. Mr. F. Knab (1913), discussing it solely from the point of view of the rôle of the mosquito, says:—

"There are a number of strong reasons why the explanation of Drs. Surcouf and Gonzales Rincones cannot be accepted. First, the eggs are found attached to a part of the mosquito's body which does not come in contact with the leaf surface when she rests upon it: Janthinosoma rests with the body well elevated upon its long legs. Secondly, the eggs are attached in a definite way by their bases and with the hatching end outward. This would hardly be the case if the eggs were picked up accidentally by the mosquito. Thirdly, were the eggs laid upon the surface of leaves they would be much more likely to become attached to other insects, such as would not bring about their transfer to a suitable host. This last objection is strengthened by the fact that mosquitoes are not ambulatory insects, but, on the contrary, move about as little as possible when not on the wing."

This is quite right, in so far as it is an argument against the surmise put forward by Dr. Surcouf, who says:—

"Therefore, we believe, that the eggs, slightly glued on to the leaves, attach themselves to the Janthinosoma that may happen to walk over them; those which adhere to the abdomen remain attached to it; the thorax is protected by the episterna and elongate coxæ, and the eggs which stick to the legs and wings fall off during the walk or flight of the insect."

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I am surprised that Dr. Surcouf, who has so carefully observed and described the admirable way in which the eggs are clamped on to the mosquito's abdomen, should for a moment entertain the idea of their becoming glued in the loose and ready manner suggested. With regard to the leaves, if the eggs really do occur on foliage, they will, no doubt, be found to be just as firmly attached. Popular opinion is irrevocably fixed upon this point, as I have been able to ascertain myself, and I am quite prepared to believe that this mode of oviposition may very well occur, and that, on hatching, the young larvæ, like those of ticks, may be quite capable of clinging on to any suitable host sweeping through the herbage.

That flies should at times deposit their eggs on clothing is by no means impossible; neither, of course, can we deny the possibility of fallen larvæ reaching their hosts by crawling from the ground.

The most interesting, and to all appearances a very frequent, method of infestation is that brought about by the agency of the mosquito. Although known as early as the beginning of the seventeenth century, it was not until Dr. Rafael Morales published his article, in December, 1911, that any interest was taken in the old popular belief. Dr. Morales received a mosquito, labelled "carrier of Colmoyotes," from a gentleman of Quirigua, whose name should have been recorded. The eggs containing living larvæ were still adherent to the gnat's abdomen, and Dr. Morales, by rearing the larvæ, was able to prove that they were, as suspected, the young of *Dermatobia hominis.* Already, two months previously, Dr. Nunez Tovar had made similar observations, but, unfortunately, they were not published until December, 1913.

Owing to Dr. Roubaud's courtesy, I have been able to examine, at the Institut Pasteur in Paris, the mosquito with Dermatobia eggs adherent, described by Dr. Surcouf. Another specimen, presented by Dr. Gonzales Rincones, was kindly placed at my disposal by Dr. Andrew Balfour, Director of the Wellcome Bureau of Scientific Research. In both these specimens the Dermatobia ova are disposed, clustered and fastened in such a manner as to exclude any method of fixation other than direct oviposition by the fly on to the body of the mosquito. Dr. Morales (1911) had already suggested that the eggs are fastened to the mosquito by the fly herself.

Fig. III.—*Janthinosoma lutzi* Theobald, with eggs of *Dermatobia hominis* attached to abdominal segments.

(Specimen in the collection of the Wellcome Bureau of

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Knab also, from the way the ova are cemented to the mosquito and to each other, considers that the "evidence points rather to a definite instinct on the part of the mother *Dermatobia* to seek out the mosquito as the vector for her progeny." Further, he adds: "On the other hand, the claim that the fly captures the mosquito and attaches the eggs to her, needs verification."

Dr. Lutz tells me that Dr. Aragao and he saw Dermatobias holding between their legs other Diptera. On three occasions Dr. Lutz saw on horses flies carrying clusters of white eggs on their backs. One of these was captured and proved to be a specimen of *Anthomyia heydenii*, Wied.; the eggs fastened to it correspond in a general way with those subsequently figured and described by Gonzales Rincones and Surcouf as Dermatobia eggs. Dr. Lutz does not look upon this method of oviposition as the normal one, but in so far as it does take place he thinks that the flies or mosquitoes must be surprised whilst perching on an animal for the purpose of sucking either blood or sweat. *Anthomyia heydenii* is frequently found imbibing sweat on horses.

Dr. Lutz's observations lead us to consider the various possible carriers of the Dermatobia ova. Dr. Gonzales Rincones found that the egg-bearing mosquitoes captured by Dr. Nunez Tovar belonged to the genus Janthinosoma; Dr. Surcouf determined the one sent to him as *Janthinosoma lutzi.* Probably other species such as *Janthinosoma posticata,* for instance, may also be concerned. Father Bernabé Cobo (1653) says the colour of the incriminated mosquito is somewhat reddish. Both *J. lutzi* and *J. posticata* are wood species. Other genera of mosquitoes are also incriminated. Knab (1913) says:—

> "The writer while on the Isthmus of Tehuantepec, in 1905, found this idea (the belief that the Dermatobia larvæ are acquired through the sting of a mosquito) warmly defended by the natives, and certain large mosquitoes (*Psorophora*) were pointed out to him as the 'madre del gusano' (mother of the worm)."

He points out that Psorophora is hardly separable generically from Janthinosoma. Blanchard (1896) states that, in 1893, Da Silva Araujo sent him various flies which were incriminated by the natives as vectors of the Berne. These flies were specimens of *Lucilia ruficornis* Macquart, *Sarcophaga chrysostoma*, Wd., *S. plinthopyga*, Wd., and an *Hystricia.* According to Dr. Neiva, in some parts of Brazil large hairy flies of the type of *Echinomyia* or *Hystricia* are considered to be the parents of the Berne.

Finally, in Trinidad, Mr. Urich told me that he had found Dermatobia eggs attached not only to mosquitoes (Janthinosoma), but also to a Muscid, which he did not determine.

Possibly the female Dermatobia is not always over particular in the choice of the insect to whom she entrusts her progeny. However, she certainly chooses some insect which is likely to reach a suitable host, and, so far as we can judge from the information at hand, certain mosquitoes, especially those of the genus Janthinosoma, seem to be the preferred agents. A fact which undoubtedly proves judicious selection is that the Dermatobia never attaches her ova to a male Janthinosoma, but, invariably, to a newly-emerged, blood-sucking, host-seeking female.

In his article on "The Aeroplane of the Macaw-worm," Dr. Gonzales Rincones draws attention to a colour affinity between the Dermatobia and the Janthinosoma. He says, "the colour of the fly's abdomen is of a brilliant, attractive blue. The abdomen of the mosquito is likewise resplendent owing to the violet, murrey, and sky-blue scales which bedeck it. It is the most beautiful mosquito I know in Venezuela. Are the larvæ deceived or do they merely prefer the abdomen which most resembles that of their mother? It is one of the mysteries of parasitism."

In Trinidad, whilst travelling in Mr. Urich's pleasant and instructive company, I stopped one day in the Majaro "high woods" to examine the water containing flowers of the Balisiers (*Heliconia caribœa*) for insect larvæ. As I touched one of the flower-spikes a fly with gilded face and enamel blue abdomen flew off like a dart. It may have been a Dermatobia. I was struck by the great resemblance in colour between the deep blue abdomen of the fly and the lapis-lazuli seed vessels

within the crimson and black flower cups, which look like parrot beaks upside down. I looked at once for Dermatobia eggs on all the leaves of the wild plantain but found none. Meanwhile, numerous ants, wasps and mosquitoes of all kinds, including bloodthirsty Psorophoræ and loveliest azure Megarhini, obliged me to retreat, wondering whether there might be any reason for the association of the blue insect and the blue seed I had found so near together.

This interesting association between the Dermatobia and the mosquito seems extraordinary at first sight, but no doubt we can guess how it came about. In the first place, we have numerous instances of insects capturing other insects and placing them with their progeny in a living condition, but totally paralysed, in order that they may serve as food for their young in due season. Thus in the Southern United States the large digger wasp (*Sphecius speciosus*, Say) seeks out the dog-day Cicada (*Tibicen pruinosa*, Say) to oviposit upon it. Having caught its victim, it gives it a sudden sting which reduces it to a comatose condition, from which it never recovers. Then, straddling it with its legs, it drags it along or flies down with it to its nest. The white, elongate egg of the wasp is laid under the middle leg of the Cicada, and when it hatches the larva begins at once to draw nourishment from between the segments of its victim. The ichneumon flies are all parasitic upon other insects, especially upon caterpillars and upon the larvæ of flies and beetles. Collectors of butterflies know full well how often the rearing of some rare specimen has been frustrated by the development of an ichneumon fly larva laid in the specimen before it was captured. Examples of insects being used merely for the purpose of conveyance to suitable feeding grounds are not wanting. Thus, for instance, *Chernes nodosus*, one of the chelifers or book-scorpions, clings to the legs of the house fly solely to be transported from one place to another, just as many small birds, incapable of long-sustained flight, travel on the backs of migrating cranes. The females of the South European bug, *Phyllomorpha laciniata*, place their eggs on to the spinous, saucer-shaped backs of their males, who then carry them about until hatched, a procedure not uncommon amongst several kinds of fishes, the males of which take charge of the eggs and young, carrying them in their mouths (*Arius*, *Osteogeniosus*, *Tilapia*, etc.), or in special receptacles (*Hippocampus*).

The association between Dermatobia and mosquito probably arose from the fact that the Œstrid larvæ deposited on the skin of cattle found it easier to avail themselves of the wound made by the proboscis of a blood-sucking insect than to bore a passage themselves through the thick hide of their host. A similar association probably exists between Hypoderma and the Tabanids. The Hypoderma larvæ either penetrate the skin through the large punctures made by the Tabanids, or the irritation occasioned by the latter cause the animal to lick the part, and thus the young Œstrid larvæ gain access to the mucosæ of the alimentary tract, which are more easy to penetrate than the hide. Thus it may be that the ovipositing Hypoderma chooses not the parts most frequently licked, but those most frequently attacked by blood-sucking flies. The further step taken by the Dermatobia in fixing its eggs on to the body of a mosquito or other insect which is likely to visit a suitable host, either for the purpose of sucking blood or of imbibing the secretions of wounds, is not more wonderful than that taken by our cuckoos or the South American cow-birds in cunningly placing their eggs for fosterage in the nests of other kinds of birds.

Symptoms.

Not infrequently the Dermatobia larva causes very little inconvenience. Dr. Costa (quoted by Blanchard, 1892) mentions a child, only a few months old, who fostered eight of these larvæ in various parts of the body without presenting the least reaction. The accurate naturalist, Dr. L. Conte (quoted by Leidy, 1859), states that the presence of the maggots in his travelling companions, in Honduras, gave rise to comparatively little discomfort. Grube (1860) relates the history of a patient who had complained of nothing save a slight itching at times. The Spanish zoologist, Jimenez de la Espada, suffered himself from this form of myiasis whilst travelling in Amazonia, but felt nothing more than some itching. Another naturalist, M. Forel (quoted by Blanchard, 1896), tells us that, whilst exploring the forests on the northern slope of the Sierra Nevada in Colombia, he

became the host of some Dermatobia larvæ. These, however, never hindered him in his pursuit of collecting ants and only from time to time caused a somewhat unpleasant lancination. Dr. Bleyer (1900) says that many of his patients had been actually unaware of the presence of the maggots they harboured until informed by their comrades who happened to notice the swellings.

As a rule in the morning or evening the affected person suddenly experiences a sensation of itching, or may-be a sharp pain at or near the place where the warble is about to appear. A small rounded swelling forms, and gradually, with the growth of the swelling, the pain increases.

The pain is not continuous, but intermittent; it comes on suddenly, lasts two or three minutes with varying intensity, and subsides as suddenly as it arose. These pain-paroxysms may occur at any time, but they are especially troublesome in the early morning and in the evening.

The pain may be very acute while it lasts, and has been compared to the sensation experienced when thorns and needles are thrust sharply into the flesh, to that produced by the stabs of stinging and phlebotomous insects, and to the shooting and lancinating pains of certain abscesses. Boucard (quoted by Coquerel and Sallé, 1859) says: "During the first month one feels at every instant sharp pains, as if needles were thrust deeply into the flesh. I thought I was being pricked by *choche* thorns." Sometimes the pain becomes very severe and troublesome and the patient finds it necessary to press the swelling with force in order to obtain some relief.

The intensity of the pain depends to a great extent, of course, on the location of the parasite. Grube (1860) reports the case of a Costa Rican in whom the larva chose the region of the nose. The pain was terrible. No less painful, and far more dangerous, is the development of the larva within the orbital cavity. Dr. Brick (quoted by Say, 1822) had a Dermatobia warble in the left leg, over the upper and front part of the tibia, which caused him at times almost intolerable pain. He says: "The severe pain which I experienced for those periods I attribute to the irritation of some of the branches of the nerves distributed to the parts, by the worm in its progress." The larva had travelled on the periosteum along the tibia for at least two inches.

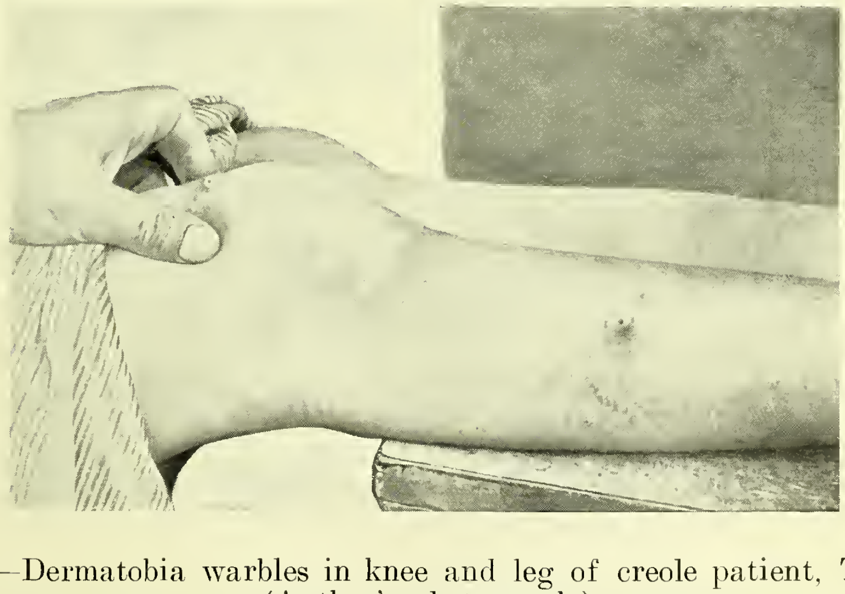

Fig. IV.—Dermatobia warbles in knee and leg of creole patient, Trinidad. (Author's photograph.)

The warble resembles a boil or furuncular nodule of considerable size, its dimensions increasing with the growth of the enclosed larva and with the amount of serous infiltration surrounding it. When the larva is full grown and ready to pupate, the swelling may measure from two to three centimetres in diameter and project as much as one centimetre above the level of the circumjacent skin. In shape it is rounded or more or less acuminated, its surface is stretched, and it presents, as a rule, a dark-red or bluish-red colour. At the apex, always more or less centrally placed, is a small circular opening similar to that produced by a large needle. This

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orifice, which is hardly visible at first, attains a diameter of from three to six millimetres in those swellings from which the maggots are ready to emerge. The opening may be partly obscured by coagulated and dried matter, which usually incrusts its margins, forming a kind of scab. The swelling feels hard to the touch, and pressure is invariably followed by the escape of a small quantity of cloudy fluid. From time to time, even without pressure, this semi-purulent serosity oozes out of the warble opening. Sometimes the secretion is quite abundant and continual. Jimenez-de la Espada says: "Some very liquid pus flowed abundantly along my leg, oozing out of the opening pierced at the apex of the swelling." The discharge is serous, yellowish, sometimes streaked with blood. Examined under the microscope it shows pus corpuscles, and a few erythrocytes. On wiping off the droplet of ichorous fluid oozing out of the orifice, one can clearly perceive, in the last weeks of development of the warble, a moving whitish, vesicular body, marked by two tiny spots of brownish yellow. It is the posterior extremity of the larva with its chitinous stigmatic plates. As a rule, the larva keeps its posterior end close beneath the cutaneous opening in order to take in the air and void out its excrement. At the least contact it will withdraw itself quickly from the mouth of the opening, approaching it again after a certain time has elapsed. By compressing the swelling the posterior end of the wriggling larva may be made to protrude somewhat from the warble's orifice.

In many cases the patient presents only one warble, in others several, either in close proximity or scattered about, and occupying the most distal parts of the body. Often in dogs and oxen hundreds may be seen clustered together about the shoulders and back, the serous discharge issuing from the numerous openings matting the hair in the neighbourhood in an unsightly manner. As a rule, there is one larva only to each warble, but occasionally two or more may be found within the same cavity. Goudot states that, when oxen are greatly riddled by warbles, one may see three to five larvæ escape from a single orifice, and Folkes (1897) mentions finding in one of his patients five Dermatobia larvæ in one warble.

It is possible that the duration of the growth-period of the larva beneath the skin may vary in accordance with local seasonal conditions. Linnæus (1781) puts it down to six months. Boucard (Coquerel and Sallé, 1859) states that as a rule the larva remains about three months between flesh and skin. Mr. E. E. Austen (1910), mentioning a larva in the British Museum collection presented by Sir Francis Laking, and removed in London, in 1897, by Sir Frederick Treves from a patient who had returned from Central South America, states that in this case it is believed that seven months had elapsed between the time when the egg was deposited and that at which the larva was removed.

Towards the end of the larval stage the full-grown maggot prepares to escape from its warble. In order to do this, it wedges the posterior extremity of its body into the warble opening and keeps it there for some time, exerting compression after the manner of a laminaria tent. It then withdraws it for a while and repeats the operation again and again until it has succeeded in dilating the opening sufficiently to enable it to squeeze through. At length it presses itself gradually out, tail end foremost, by means of vermicular contractions aided by the compressibility of its annulated body and by the stout ring-encircling spines which prevent its slipping back again into its former cave. On emerging from the warble it lets itself fall to the ground, and, slowly crawling along the floor by means of its spines and the contractions of its body rings, it endeavours to reach some place of safety in which to undergo pupation.

The exit of the larva from the warble may occur at any time of day, but as a rule it takes place either in the early morning hours or at night. During growth, and especially at the time of exit, the patient can distinctly feel the larva moving within the close cavity of its warble.

Dr. Hill (1830), relating the history of a case in a ship's steward who had contracted the parasite in British Guiana, says:—

> "The patient felt something moving in the centre of a small orifice which had become apparent on the tumour. The motion increased, till to his surprise the head of an animal protruded itself, and this it continued to do

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daily, though the animal was observed to withdraw into its burrow when anyone came near or even pointed at it. The pain at this time was so acute as to cause sickness. The chamber of the insect seemed exactly to fit its body and merely admitted of its motions outwards and inwards. It occasionally discharged a quantity of blood-coloured matter. It was observed to protrude more and more of its body every day, and upon one occasion it came out to the length of more than an inch. At last it dropt out of its own accord upon the floor with a noise resembling that which a pebble would make on falling on the ground. It kept moving and turning about for some time like an earth worm, but ere long shrunk into nearly half its previous size. The insect lived for three days and was then put into spirits, after which it shrunk still more. Calculating from the period at which the itching was first felt, it had lived in the arm for about six weeks."

Soon after the escape of the larva one can squeeze a quantity of thin sanious fluid out of the cavity. In some cases the discharge is thick and muco-purulent. The empty warble presents the aspect of an ordinary furuncle after removal of the central necrosed mass or core—a hollow cavity with surrounding infiltrated tissue. On probing the cavity one finds that it is only slightly larger than the volume of the maggot it had contained, and that its long axis is perpendicular to the surface of the skin. The swelling diminishes rapidly as soon as the grub is out, and the cavity closes up by granulation, leaving behind a hardly perceptible scar.

As a rule, there are no constitutional symptoms, with the exception of sleeplessness at night owing to the recurring pain, but occasionally there may be some malaise, a feeling of general lassitude, loss of appetite, and sometimes a slight febrile reaction.

Various complications, such as erysipelas and tetanus, may arise owing to bacterial agency. The inflammation round the warble may increase considerably and be followed by lymphangitis and swelling of the proximal glands. Occasionally the larva may perish during development and the warble become an abscess. When this happens the orifice is choked up and covered by a thick scab, and the incision of the abscess, or pressure on its base causes the escape of a greenish pultaceous mass of bad odour constituted of pus and the remains of the disorganized larva. Sometimes after the escape of the larva the granulation tissue filling the cavity becomes infiltrated with lime salts and gives rise to hard nodules which persist beneath the skin. Not infrequently, especially in cattle, other kinds of flies (*Sarcophagidæ, Muscidæ*) oviposit into the recently emptied warble and their larvæ give rise to fearful sores.

Treatment.

On seeing a case of Dermatobia for the first time there is an instinctive tendency to endeavour to extract the grub at once, either by using forcible compression or by making an incision.

In an advanced case, when the maggot is ready to pupate and the warble orifice is patulous, compression of the swelling, from the base upwards, by means of the two thumb nails, may bring about the expulsion of the enclosed larva quite readily, indeed it is likely to bolt out as if pushed by a spring. As a rule, however, it is difficult to dislodge the maggot, as it holds on tenaciously by means of its strong oral hooks and numerous body spines. In an earlier stage, when the larva is gourd-shaped and the warble opening very small, it is still more difficult to squeeze it out, and the attempt is likely to cause unnecessary pain. A simple incision is not always sufficient to remove the parasite, but may serve to enlarge the opening prior to digital compression. Matas (1888) says: "Guided by the orifice in the elevation I cut with the point of a bistoury into the very centre of the swelling, but discovered, however, that by simply cutting vertically I had not incised the cavity wherein the larvæ lay concealed, and was obliged to again incise obliquely and to the right in order to expose the parasite burrow. This oblique direction of the larval sinus I found to be constant in each of the three 'stings.' I found that the larvæ were lodged immediately under the derma proper, so that in getting at them, in order to expose them thoroughly, I had to cut completely through the skin, which in the gluteal region is particularly thick. It was also discovered that a simple incision

was insufficient to remove the larvæ, and that digital expression, and this very forcibly applied, was necessary in order to induce them to relinquish their strong hold."

The natives of intertropical America, familiar with this form of myiasis, do not use the knife. They proceed as follows :—First they kill the maggot within its warble, either simply choking it or poisoning it by means of tobacco and other drugs. As a rule, both choking and drugging are combined. Then after some hours the dead or narcotized larva is squeezed out quite easily. Tobacco is the almost universal remedy. It is used in various ways: the leaf is applied over the swelling, or the juice or smoke or hot ashes are introduced into the warble opening. The use of the leaf is mentioned by Arture (1757) for French Guiana, by Logan (1892) for Spanish Honduras, by Folkes (1897) for Guatemala, and by Keyt (1900) for British Honduras. Logan says: "The common remedy adopted in Honduras was to place a piece of leaf tobacco over the perforation in the skin, and soon after the maggot could be squeezed out." Dr. Keyt says: "Application of tobacco leaf over the swelling and occluding the orifice kills or narcotizes the worm, and its expulsion is easily effected by squeezing."

Bates (1863) relates that an old Indian of Ega, Amazon River, Brazil, showed him "how to stupefy the grub with strong tobacco juice, causing it to relax its grip in the interior and then pull it out of the narrow orifice of the tumour by main force."

In Colombia tobacco juice is introduced into the opening and sticking-plaster glued over it. About twenty-four hours later a slight pressure suffices to expel the dead larva.

Among the natives of Brazil chewed tobacco, or the dry tobacco leaf crushed and mashed in water or spirits of wine, is used. Matas says the natives of Honduras apply hot tobacco ashes to the parts and follow this up by digital expression. According to Folkes some blow tobacco smoke into the hole, thus killing the larva.

Guyon (1835) wrote that, in Trinidad, a mixture of tobacco and pimento (*Pimenta officinalis*) is used to kill the larva, and, according to Arture, in Cayenne leaves of the *choux caraïb* or tania (*Colocasia esculenta*) are sometimes applied over the warble. In Brazil, a plaster of almecega, the resin of *Bursera balsamifera*, one of the *Terebinthinæ*, is applied, or the viscous, milky sap of the Lecherillo, a *Tabernæmontana* of the dog-bane family (*Apocynaceæ*), smeared on lint, paper or leaves, is placed over the swelling. The maggot, in order to get at the air, presses the posterior end of its body against the plaster and its stigmata become glued in the thickened caoutchouc-containing latex. Hence frequently on removing the plaster the larva comes away with it.

Mercurial plaster and ordinary sticking plaster are also frequently used by physicians. According to Duprey (1906). the Trinidad natives use a plaster made of brown paper coated with soft tallow. Folkes says some of the ingenious Gringoes of Guatemala hit on the idea of placing a postage stamp over the hole.

According to Herbert Smith (1892) the Brazilians often tie a piece of fresh pork-fat tightly round the warble; the maggot is thus deprived of air, and, in the effort to obtain it, emerges from the skin, burrowing into the pork. Smith recommends putting a drop of strong carbolic acid in the opening and leaving it until next day, when the maggot can be easily squeezed out. Boucard (quoted by Coquerel and Sallé, 1859) stated that he found turpentine to be excellent; it killed the larvæ immediately. In many parts pure creolin is used. Cotton compresses, soaked in a solution of carbolic acid 4 per cent. or sublimate 1 per cent., give the same results. According to Major J. G. Barnard (1852) the natives on the Isthmus of Tehuantepec "sometimes use fire to kill them."

Folkes says the method he first employed was to cut them out, but, as most patients were afraid of the knife, he adopted the following:—"I have never failed; it is the most rapid manner. On one occasion, I removed 14 in less than two minutes. After putting a little chloroform into a hypodermic syringe I insert the point of a fine needle into the orifice and then into the body of the worm. A few drops will paralyse the worm, which can be squeezed out in a moment. Simply washing the wound and putting on a little piece of cotton are the dressings required. In a few days no evidence of the former tenant can be found."

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Prevention.

In Europe, where the ovipositing Œstrid flies occur for about two or three months only during the year, where the myiasis is almost entirely restricted to domesticated cattle, and where the herds are usually small and fully under control, prevention is comparatively easy. Indeed, in many instances judicious measures, such as the prevention of oviposition by means of sticky or noxious-smelling substances smeared over the animals, the killing of the maggots in the warbles, and the housing of the herds, or their confinement in appropriate sheds, during the season of oviposition, and especially during the hottest hours of the day, when the flies are active, has given good results. But the difficulties are far greater in the case of the neotropical Œstrid, whose activity lasts practically the whole year, whose strongholds are inaccessible virgin forests, whose reservoirs are numerous wild mammals and birds, and who, aided by insect associates, has full sway over the large herds of semi-wild oxen which graze in the llanos of South America. However, even in tropical America the pest is being actively combated, and, just as in Europe we are aided by starlings, jackdaws, redstarts, hoopoes, thrushes, wagtails, and titmice, so also in America the cow-birds (*Molothrus*), the tick-birds (*Crotophaga*), and numerous other birds range themselves on the side of man, and should be carefully protected.

In speaking of the zoological distribution of *Dermatobia hominis*, I have mentioned the remarkable immunity of the white cattle of Antioquia. Here, therefore, I should like to point out that, with regard not only to myiasis, but to all tropical diseases and conditions, it may not be always altogether wise to endeavour to improve local stock by means of animals imported from abroad, and thus possibly destroy valuable immunities and adaptations which may have taken centuries to become established.

LOUIS W. SAMBON.

February, 1915.

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APPENDIX VIII.

Reports on work carried out in Colonial Laboratories.

No. 1.

MALAY STATES.

THE HIGH COMMISSIONER to THE SECRETARY OF STATE.

(Received 24th January, 1914.)

SIR, Government House, Singapore, 31st December, 1913.

WITH reference to my despatch of the 4th June, 1913,* I have the honour to transmit a report on the work done at the Institute for Medical Research, Kuala Lumpur, for the period 1st April to 30th September, 1913.

I have, &c.,

ARTHUR YOUNG.

Enclosure in No. 1.

REPORT FROM THE INSTITUTE FOR MEDICAL RESEARCH FOR THE PERIOD 1ST APRIL TO 30TH SEPTEMBER, 1913.

UNPOLISHED RICE AND THE PREVENTION OF BERI-BERI.

SINCE the publication of our completed report on the etiology of beri-beri in 1912 various communications have been published by investigators who have sought to isolate from rice polishings the substance or substances which are of value in the prevention of beri-beri.

We found that by the extraction of polishings with acidulated alcohol a preparation was obtained which was effective in preventing the occurrence of polyneuritis in fowls fed on polished rice, and of curing that disease in these animals. It is to extracts prepared by this method, or similar ones—for an effective extract can also be prepared by means of acidulated water—that physiological chemists have devoted their efforts.

In this domain much work has been done by Funk, who tested the value of the various substances which he isolated on pigeons suffering from polyneuritis induced by the consumption of polished rice. To a curative substance prepared by him he assigned the name " vitamine," and gave it a formula calculated from the results of a single analysis; this formula he subsequently amended. As the molecular weights are unknown, and as in the case of complex substances from the results of a combustion several formulæ can usually be worked out, it is obvious that the formulæ cannot be accepted without question. Moreover, from the variety of formulæ he has given it is suggested that the substances were impure, and, but for the fact that he has reduced the volume of the material in which the active substance or substances are contained, a proprietary name might quite as reasonably have been applied to the curative fraction isolated by us and known to be a mixture of substances. Indeed, Tsuzuki has applied the name " Anti beri-berin" to the moist, black, sticky residue obtained on evaporation of the alcoholic extract.

Reasonable allowances for the magnitude and difficulties of the task confronting physiological chemists must be made, but the methods employed in the work require improvement; those now in use are crude and are sources of errors because of the incomplete separations they effect, and because of the decomposition they so constantly produce. It may well be that the substance or substances which prevent beri-beri are elusive bodies and may never be isolated in a state of purity, but these problems in no way concern the physician or administrator, whose work deals with the prevention and cure of beri-beri.

The fact that the continuous consumption of polished rice as the staple of diet gives rise to beri-beri in man rests on quite other testimony than that derived from experiments on fowls and pigeons, and the fact is equally well established that when rice-eaters substitute unpolished rice for polished rice the disease does not occur.

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* Page 202 of [Cd. 7261], March, 1914.

Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

Further valuable confirmatory evidence has recently been obtained from the results of the expedition conducted by Dr. Wollaston and Mr. Kloss into the interior of Dutch New Guinea, where they had as their objective the exploration of the Snow Mountains.

The task which confronted them was, as both of them well knew, a formidable and an arduous one. Previous experience had shown them that the occurrence of beri-beri among them meant failure; thus the Goodfellow expedition of 1909-1911, undertaken to explore the Snow Mountains, was decimated by disease, and Dr. Wollaston, the Medical Officer to that expedition, has recorded that "in the six months from the beginning of June to the end of November, 39 men showed definite signs of beri-beri, and seven deaths were directly attributable to this cause." The staple of diet was polished rice.

A similar fate befell all previously recorded expeditions into that country, save the one conducted by Moszkowski, and in which unpolished rice was used, but as his expedition only numbered ten men the results were inconclusive.

Convinced, therefore, that the work of the expedition could not be accomplished if their camp-followers and guard were fed on polished rice, Dr. Wollaston and Mr. Kloss decided that only unpolished rice should be used.

Here another difficulty confronted them. The only variety of unpolished rice which can be purchased in the Malay Peninsula in the open market is that known as parboiled rice. To that variety of rice the natives of India who immigrate to this country are accustomed, and it is preferred by them. It has, however, an objectionable odour and appearance; irritating properties have been ascribed to it, and it has even been thought to predispose to dysentery and the like disease. Parboiled rice can be prepared free from these objectionable properties, but the manufacturers will not do so, and abundant practical experience has shown that the use of parboiled rice is not the solution of the problem of beri-beri prevention.

Braddon held that parboiled rice was a preventive of beri-beri, because it had been "cured," and that white rice was harmful because of some poisonous substance contained in it. The brilliant results obtained by the use of parboiled rice in the Government institutions of Malaya confirmed the accuracy of his view that such rice was a preventive of beri-beri, but when we proved that white rice was harmful because, by the process of polishing, the sub-pericarpal layers were removed, and that parboiled rice was only a variety of unpolished rice, the problem was entirely altered, and the prevention of beri-beri was established on a rational basis.

Chinese, Malays, Javanese, and the like may, when deprived of their liberty in prison, be compelled to partake of parboiled rice, but on regaining their liberty they will not continue its use. If, on the other hand, an ordinary unpolished rice, or "kampong" rice, were in use in such places, a demand would be created for that rice, which would then become available commercially. In this way some real progress might be recorded towards the eradication of a preventable disease. Fortunately, in Java, where the use of parboiled rice is unknown, Dr. Wollaston and Mr. Kloss were able to obtain a supply of unpolished rice adequate for the needs of their expedition. In addition, acting on the suggestion of the writers, they took with them as an additional safeguard a supply of our remedial agent, the use of which we have advocated in the prevention and cure of beri-beri.

The expedition consisted of 204 natives of the Malayan Archipelago, who were rice-eaters, together with two Europeans and four Eurasians.

They left Batavia about the end of August, 1912, and reached Dutch New Guinea in the middle of September. After reaching the coast, the explorers constructed canoes and ascended the Utakwa River. They went as far as they could go by water, the journey taking two days. They then proceeded overland by stages, each stage occupying three days. Depôts had to be constructed at each stage, an undertaking of considerable magnitude, which occupied much time.

Four and a half months after they had arrived at the coast they reached the Snow Mountains, and then commenced their return journey to the coast, which was reached in two months.

The expedition was in all of seven months' duration, and, despite the laborious nature of the work, among the 204 rice-eating natives no single case of beri-beri occurred. The general health conditions of the expedition are reported to have been excellent.

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The daily ration issued to the natives was as follows :—

Rice	700 grms.
Fish or meat on alternate days	150 grms.
Kachang idju	200 grms.
Javanese sugar	50 grms.
Coffee	20 grms.
Tea	5 grms.
Salt occasionally	20 grms.

Two varieties of unpolished rice were used, one with a red pericarp during the first five months and one with a silvery pericarp during the last two months. Neither rice could be considered satisfactory from the cosmetic stand-point. In the case of the red variety only a partial attempt had been made to remove the pericarp, and in the case of the silvery variety no attempt had been made to remove this valueless layer of the grain.

Despite the appearance no objections were raised by the natives to the use of these rices, but steps ought to be taken to induce manufacturers to remove the pericarp, and so improve the appearance of the grain.

In this connexion attention must again be directed to the valueless character of this structure. In previous reports the evidence has been furnished on which this statement is based, but writers, with but one or two notable exceptions, refer to the pericarp as the structure whose removal makes the rice harmful, whereas, in fact, it is the removal of the subpericarpal layers which is attended with this undesirable result.

The photograph of a transverse section of a selected grain, which was prepared by the method described on a previous occasion, shows clearly the position of these structures. No real progress in the application of preventive measures can be made until there is available commercially an unpolished rice from which the pericarp has been removed.

Transverse Section of a Grain.

Selected from the rice used on Wollaston-Kloss Expedition.

A = Pericarp (valueless).
B = Subpericarpal Zone, the removal of which, in the process of polishing, converts a harmless into a harmful one.

Zeiss-Microplanar, 20 mm.

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Samples of both the rices used were analysed here with the following results :—

	Red variety Per cent.	Silvery variety. Per cent.
Protein	9.22	9.41
Fat	1.14	2.10
Carbohydrate	78.64	76.57
Ash	1.06	1.50
Moisture	9.94	10.42
P^2O^5 in ash	0.54	0.79

It has been consistently advocated that a rice which yields not less than 0.4 per cent. of phosphorus pentoxide may safely be regarded as a harmless one, and both of these rices are considerably over this standard, but only in the red variety did any of the grains show a partial removal of the subpericarpal layers and in the silvery variety the grain had only been deprived of its husk.

Had the enterprise of manufacturers so far progressed as to remove the pericarp and embryos from these grains, the results would have been equally satisfactory as regards the prevention of disease, the analysis would still have yielded results in accordance with the standard of safety, and the cosmetic appearance of the food-stuff would have been greatly improved.

No fresh fish or meat was available during the expedition, but only salt fish and dried, spiced beef.

Based on the standards we have previously adopted, the ration was ample, and the scientific findings are thus in complete accordance with the actual facts.

The results of this expedition as regards beri-beri are in striking contrast with those which obtained in all previous large expeditions into Dutch New Guinea, and taken in conjunction with the observations and experiments previously recorded by us, the absence of beri-beri on this occasion can only be explained in one way, that is, the absence of polished rice from the diet.

In 1909, we demonstrated—

1. That beri-beri as it exists in the Malay Peninsula is caused by the continuous consumption, as the staple of diet, of rice from which all or the greater part of the subpericarpal layers has been removed by the process of polishing.
2. That a satisfactory measure of the degree of polishing to which a rice has been subjected is the estimation of its total phosphorus in terms of phosphorus pentoxide.
3. That a rice which yields less than 0.4 per cent. of phosphorus pentoxide cannot safely be permitted to form the staple of a diet in man.

The evidence now submitted is a complete confirmation of the accuracy of these statements, which, as we have repeatedly affirmed, were the logical deductions derived from systematic research.

Recently writers from Southern Nigeria and Brazil have disputed the accuracy of these conclusions, but we are unaware of any systematic observations having been carried out in these countries which would permit of a decided statement being made. When these are made it will be essential to determine that the disease known to them as beri-beri is the same as the disease which is known by that name here. After all, beri-beri is only a form of polyneuritis, and students of this disease know that not only forms of polyneuritis of different origin have been called beri-beri, but that diseases of which polyneuritis may not be a prominent feature, such as "epidemic dropsy," "Ceylon beri-beri," and the like, have been included under this name.

We have shown the mode of operation of the factors concerned in the etiology of beri-beri as it occurs in the Malay Peninsula. The painstaking researches of Highet and his colleagues have proved that the disease is of similar origin in Siam, whilst the work of Strong and Cromwell has furnished similar evidence for the Philippine Islands. In the Netherlands India these results are in complete accordance with those obtained by the very able Dutch investigators.

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There is, then, in the countries mentioned an endemic and epidemic disease which presents certain clinical features, and is known to clinicians in these countries as beri-beri. For the occurrence of that disease an explanation has been given. The disease can be prevented and, as we have shown elsewhere, may be cured. But remembering the old adage that " prevention is better than cure," it is necessary to consider the practical application of preventive measures.

While fully appreciating the work of the scientists who seek to advance our knowledge on this subject, we must be practical and attempt to reduce, if not abolish, the heavy toll which is yearly exacted by this disease.

We have consistently advocated the preparation of an unpolished rice, that is a rice from which the husk and the pericarp have been removed, and which shall yield not less than 0.4 per cent. of phosphorus pentoxide. Such a rice can be and has been produced in Siam, but in the absence of a demand for it its preparation was not continued. The Governments of the countries concerned can create such a demand by making its use compulsory in all gaols and public institutions. In the Malay Peninsula that form of unpolished rice known as parboiled rice is used in practically all such places, but, for the reasons we have mentioned, the use of that rice cannot be extended among the people, and an unobjectionable, palatable, unpolished rice must be substituted.

A clause in Government contracts requiring the delivery of an unpolished rice conforming to the standard would give opportunity for observing how such a standard worked in practice, and aid in popularizing a safe and wholesome foodstuff among the people. No one believes that the introduction of such a measure would be accompanied by the immediate disappearance of beri-beri, but it is the only way in which progress in its prevention seems possible, and it would bring such prevention within the sphere of practical politics.

In striking contrast with the brilliant results of the Wollaston-Kloss expedition are the disastrous results of an expedition undertaken in 1913 to the mountain called Gunong Tahan, where the creation of a hill station for the Federated Malay States is contemplated. The expedition consisted of a survey party and comprised a surveyor with about fifty native assistants and labourers. These natives will not eat parboiled rice, but, for the reasons already stated, no other variety of unpolished rice was available commercially. They were therefore obliged to consume polished rice, and an outbreak of beri-beri occurred.

The Cure of Beri-Beri.

In the report presented for the period in 1912 corresponding to the one now under review, experimental evidence was given in favour of a remedial agent which had proved of value in the cure of *polyneuritis gallinarum*. It was proposed to extend the use of that preparation to patients suffering from beri-beri and to determine, if possible, its usefulness in this connexion.

It is a simple matter to put forward a remedy for disease and to assert that it is of value, but it is desired to ascertain by observation if the remedy possesses a real value, and, if so, to establish its use on a rational basis.

For that purpose conditions are required which are now non-existent and apparently unattainable. The work cannot, therefore, be carried out.

Leprosy.

In the two previous reports accounts have been given of experiments carried out with a view to the cultivation of the bacillus of leprosy. The results obtained were uniformly negative, and a paper dealing with these researches up to the end of June, 1913, was prepared by Dr. Fletcher and myself. It was presented at the 17th International Congress of Medicine in London. A copy of that paper is appended to this report.

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The following further experiments have since been undertaken. In these experiments the procedure originally described for obtaining leper tissue was followed, but the use of iodine as a disinfectant was omitted. Our technique has now been made sufficiently perfect to enable us, with the aid of a local anæsthetic, to dissect up a flap of a skin from a case of leprosy and to remove from the subjacent tissue a portion free from contamination by extraneous organisms.

Further experiments with serum-agar.

It is a common experience that parasitic organisms when first induced to lead a saprophytic existence do not grow profusely, but that on repeated sub-cultivation luxuriant cultures are eventually obtained.

In view of the possibility of this being true of the leprosy bacillus, the following experiment was carried out.

From a nodule situated in the left scapular region of a case of nodular leprosy (Case No. 25) a portion was excised, and from it ten tubes of + 10 nutrient agar mixed with an equal quantity of human serum were inoculated. Each tube received a portion which varied in size from a millet seed to a rice grain. The tissue swarmed with leprosy bacilli. The inoculated tubes were incubated at 37°C., and from each tube the nodule was removed after intervals varying from seven to ten days and reinoculated on a fresh tube of the medium. The process of sub-culture was repeated regularly for three months. The maximum number of sub-cultures prepared from one nodule was eleven, and in all upwards of a hundred tubes were inoculated. Not one of them became contaminated, and not one of them showed a macroscopic growth. Persistence, but not proliferation, was invariably noted.

Experiments with serum + sterile agar.

In these experiments it was designed to substitute for the nutrient agar a medium of the following composition :—

Powdered agar	... ...	40 grms.
Distilled water	... ...	1000 c.cs.

The mixture was dissolved in the autoclave and clarified with egg-albumen in the ordinary way. Tubes were then prepared each containing 5 c.c. of the medium, and to each tube was added an equal quantity of human serum in the manner previously described.

From a nodule situated in the right lumbar region of a case of nodular leprosy (Case No. 35) a portion was excised and divided into pieces about the size of a rice grain. Five tubes of the serum-agar were inoculated with these nodules. From a nodule situated just below and internal to the angle of the right scapula of a case of nodular leprosy (Case No. 36) a portion was excised and with it six tubes of the serum-agar were inoculated as in the previous case.

The inoculated tubes have been incubated at 37°C. for three months. None of them have become contaminated and a culture of the *bacillus lepræ* has not been obtained.

Experiments with English proof-agar.

With this medium luxuriant growths of various fungi can be obtained.

Five tubes were inoculated with pieces of leper tissue obtained from Case No. 35 and five tubes were inoculated with similar pieces obtained from Case No. 36.

The tubes have been incubated for three months at 37°C. None of them have become contaminated and no culture has been obtained.

Experiments with Clegg's medium.

In his first communication Clegg claimed to have grown the leprosy bacillus in symbiosis with amœbæ, a culture of which had been obtained from a case of dysentery.

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Attempts made here to cultivate amœbæ have been uniformly unsuccessful and support the view of investigators who state that the pathogenic amœbæ have not been cultivated on artificial media.

In his second communication Clegg states that he employed cultures of amœbæ obtained from water. By the methods he describes, a culture of amœbæ was prepared from water contained in a tank in the Institute and grown in pure culture with the vibrio of cholera.

Following exactly the procedure employed by him, twenty tubes of his medium were inoculated with the mixed culture of amœbæ and cholera vibrios. The inoculated tubes were incubated for twenty-four hours at 37°C. and then inoculated with leprous material.

From a nodule on the upper part of the left ear of Case No. 37, a portion was excised and emulsified with salt solution. The emulsion contained leprosy bacilli in great abundance and from it five of the tubes were inoculated, one of the tubes receiving a small piece of the tissue which had not been properly emulsified. A second portion of the nodule was excised, cut into pieces the size of rice-grains, and five of the tubes were inoculated with the fragments. From a nodule on the upper part of the left ear of Case No. 38, a portion was exercised and emulsified with salt solution. The emulsion contained leprosy bacilli in great abundance, and from it five of the tubes were inoculated.

From the same nodule a second portion was excised, cut into pieces the size of rice grains, and the remaining five tubes inoculated.

The twenty inoculated tubes were then incubated for one week at 37°C. On the expiry of that period reinoculations were made from each tube on to fresh tubes of Clegg's medium. The tubes which had been inoculated with nodules of tissue had the nodules removed to the fresh tubes along with a loopful of the amœbæ cholera culture. From the tubes inoculated with emulsion a loopful of the mixture of organisms was removed and inoculated on the fresh tubes. Smears were then prepared from each of the old cultures, stained, and examined.

The procedure was repeated once a week for six weeks.

Examination of original cultures after incubation.

The cultures which had been inoculated with nodules of tissue from Case No. 37 showed the presence of cholera bacilli, amœbæ, and acid-fast bacilli, the latter showing no change in morphology.

The cultures which had been inoculated with the emulsion prepared from Case No. 37 showed cholera bacilli, amœbæ, and acid-fast bacilli, but the latter were not so numerous as in the cultures inoculated with nodules of tissue.

The cultures prepared from Case No. 38 gave exactly similar results.

Examination of first subcultures.

In the subcultures which had been prepared with nodules of tissue from Case No. 37 many acid-fast bacilli were found. In two of them the bacilli were present in enormous numbers.

In two of the subcultures which had been inoculated with emulsion prepared from Case No. 37 acid-fast bacilli were not found, in one they were extremely scanty, in one a few scattered bacilli were observed, and in one acid-fast bacilli were quite numerous, mostly in clumps. The latter tube was the one previously referred to which had been inoculated with a nodule of tissue as well as with emulsion.

In the subcultures which had been prepared with nodules of tissue from Case No. 38 acid-fast bacilli were plentiful in each of the five tubes.

In the subcultures which had been prepared with emulsion from Case No. 38 acid-fast bacilli could be found only by a prolonged search; the bacilli were scattered, from two to five being found in a smear.

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Examination of second subcultures.

In order to facilitate reference to these and subsequent cultures, each tube was numbered.

In the subcultures which had been prepared with nodules from Case No. 37 the results were:

1. Acid-fast bacilli were present but not very numerous. There were plenty of amœbæ, both as vegetative forms and as cysts. Cholera bacilli present.
2. A few scattered acid-fast bacilli were found. There were plenty of both forms of amœbæ. Cholera bacilli present.
3. Acid-fast bacilli present, but not very numerous. There were a few of both kinds of amœbæ. Cholera bacilli present.
4. Acid-fast bacilli were scanty. Amœbæ and cholera bacilli scanty.
5. Acid-fast bacilli scanty. Both forms of amœbæ and cholera bacilli were present in moderate numbers.

In the subcultures which had been prepared from emulsion-cultures from Case No. 37 the results were:

1. No acid-fast bacilli were found.
2. Acid-fast bacilli were very numerous, but this is the culture which had a nodule of leper tissue.
3. No acid-fast bacilli were found.
4. No acid-fast bacilli were found.
5. No acid-fast bacilli were found.

There were numerous vegetative forms of amœbæ and cholera bacilli present in each film.

In the subcultures which had been prepared with nodules from Case No. 38 the results were:

1. Acid-fast bacilli present but not numerous, some scattered and a few in clumps. Cysts of amœbæ present, but no vegetative forms.
2. Acid-fast bacilli present, but not numerous, chiefly small globi. Cysts of amœbæ numerous and a few vegetative forms.
3. A few acid-fast bacilli present. Both forms of amœbæ numerous.
4. A few acid-fast bacilli present. Both forms of amœbæ numerous.
5. A few acid-fast bacilli present. Both forms of amœbæ present but scanty.

In the subcultures which had been prepared from emulsion cultures from Case No. 38, the results were:

1. No acid-fast bacilli present. Both forms of amœbæ abundant.
2. Two unaltered acid-fast bacilli found. Cysts of amœbæ numerous.
3. No acid-fast bacilli present. Both forms of amœbæ abundant.
4. No acid-fast bacilli present. A few cysts of amœbæ but no vegetative forms.
5. No acid-fast bacilli present. Both forms of amœbæ abundant.

Examination of third subcultures.

In the subcultures which had been prepared with the nodules from Case No. 37 the results were:

1. Acid-fast bacilli numerous in small clumps. Both forms of amœbæ were plentiful and cholera bacilli were fairly numerous.
2. Acid-fast bacilli numerous in small clumps. Both forms of amœbæ were plentiful and cholera bacilli were fairly numerous.
3. Acid-fast bacilli present but not very plentiful. Both forms of amœbæ present, the vegetative form being very numerous. Cholera bacilli fairly abundant.
4. Acid-fast bacilli few and scattered. Both forms of amœbæ present and cholera bacilli fairly numerous.
5. Acid-fast bacilli few and scattered. Both forms of amœbæ present and cholera bacilli fairly numerous.

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In the subcultures which had been prepared from the emulsion subcultures (Case No. 37) the results were :

1. No acid-fast bacilli present. Both forms of amœbæ were present and the cholera bacilli were scanty.
2. Acid-fast bacilli were fairly numerous, small clumps. Both forms of amœbæ were present and cholera bacilli were very scanty.
3. No acid-bacilli were present. Both forms of amœbæ were present and cholera bacilli were very plentiful.
4. No acid-fast bacilli were present. Both forms of amœbæ were present and cholera bacilli were scanty.
5. No acid-fast bacilli were present. Both forms of amœbæ were present and cholera bacilli were scanty.

In the subcultures which had been prepared with the nodules from Case No. 38 the results were :

1. Acid-fast bacilli present, scattered, and a few small clumps. Both forms of amœbæ present.
2. Acid-fast bacilli present, scattered, and a few small clumps. Both forms of amœbæ present.
3. Only two small clumps of acid-fast bacilli found. Both forms of amœbæ present and cholera bacilli very numerous.
4. Scattered acid-fast bacilli present and a few small clumps. Both forms of amœbæ present. Cholera bacilli scanty.
5. Scattered acid-fast bacilli present and a few small clumps. Both forms of amœbæ and cholera bacilli scanty.

In the subcultures which had been prepared from the emulsion subcultures (Case No. 38), the results were :

1. Acid-fast bacilli absent. Both forms of amœbæ present and cholera bacilli very numerous.
2. Acid-fast bacilli absent. Both forms of amœbæ present and cholera bacilli very numerous.
3. Acid-fast bacilli absent. Both forms of amœbæ present, vegetative forms and cholera bacilli scanty.
4. Acid-fast bacilli absent. Both forms of amœbæ present, cholera bacilli scanty.
5. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli scanty.

Examination of fourth subcultures.

In the subcultures which had been prepared with the nodules from Case No. 37, the results were :

1. Acid-fast bacilli present as numerous small clumps and few scattered bacilli. Amœbæ, both forms, present. Cholera bacilli few.
2. Acid-fast bacilli as in 1, but less numerous. Amœbæ, both forms, present. Cholera bacilli few.
3. Acid-fast bacilli present. A few small clumps, cysts of amœbæ numerous, vegetative forms scanty. Cholera bacilli very few.
4. Acid-fast bacilli present, a few small clumps. Both forms of amœbæ present. Cholera bacilli fairly numerous.
5. A few scattered acid-fast bacilli present. Both forms of amœbæ present, but vegetative forms scanty. Cholera bacilli very few.

In the subcultures which had been prepared from the emulsion subcultures (Case No. 37) the results were :

1. Acid-fast bacilli absent. Cysts of amœbæ present but no vegetative forms. Cholera bacilli scanty.
2. A few small clumps of acid-fast bacilli. Both forms of amœbæ present. Cholera bacilli few.

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3. Acid-fast bacilli absent. Both forms of amœbæ numerous. Cholera bacilli numerous.
4. Acid-fast bacilli absent. Cysts of amœbæ numerous but vegetative forms absent. Cholera bacilli few.
5. Acid-fast bacilli absent. Both forms of amœbæ numerous. Cholera bacilli very few.

In the subcultures which had been prepared with the nodules from Case No. 38, the results were :

1. Acid-fast bacilli very scanty. Cysts of amœbæ present but vegetative forms absent. Cholera bacilli very few.
2. A few clumps of acid-fast bacilli present. Both forms of amœbæ present but vegetative forms few. Cholera bacilli very few.
3. A few acid-fast bacilli present. Cysts of amœbæ present but vegetative forms absent. Cholera bacilli plentiful.
4. Acid-fast bacilli present, both clumps and scattered cysts of amœbæ present but vegetative forms absent. Cholera bacilli very few.
5. Acid-fast bacilli present, both clumps and scattered. Both forms of amœbæ present but vegetative forms scanty. Cholera bacilli very few.

In the subcultures which had been prepared from the emulsion subcultures (Case No. 38), the results were :

1. Acid-fast bacilli absent. Both forms of amœbæ present, but vegetative forms not numerous. Cholera bacilli very few.
2. Acid-fast bacilli absent. Both forms of amœbæ present, but vegetative forms few. Cholera bacilli very few.
3. Acid-fast bacilli absent. Both forms of amœbæ present, but vegetative forms few. Cholera bacilli very few.
4. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli few.
5. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli few.

Examination of fifth subcultures.

In the subcultures which had been prepared with the nodules from Case No. 37, the results were :

1. Acid-fast bacilli present, a few small clumps and scattered bacilli. Both forms of amœbæ present. Cholera bacilli plentiful.
2. Acid-fast bacilli present, a few small clumps and scattered bacilli. Both forms of amœbæ numerous. Cholera bacilli very plentiful.
3. A few scattered acid-fast bacilli present. Both forms of amœbæ present, but vegetative forms scanty. Cholera bacilli very plentiful.
4. A very few small clumps of acid-fast bacilli present. Both forms of amœbæ present. Cholera bacilli very plentiful.
5. A very few small clumps of acid-fast bacilli present. Both forms of amœbæ present. Cholera bacilli very plentiful.

In the subcultures which had been prepared from the emulsion subcultures (Case No. 37), the results were :

1. Acid-fast bacilli absent. Both forms of amœbæ present, but vegetative forms scanty. Cholera bacilli very plentiful.
2. Acid-fast bacilli present, a few small clumps. Both forms of amœbæ plentiful. Cholera bacilli very numerous.
3. Acid-fast bacilli absent. Both forms of amœbæ numerous. Cholera bacilli very numerous.
4. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli present.
5. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli very numerous.

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REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

In the subcultures which had been prepared from the nodules from Case No. 38, the results were:

1. Acid-fast bacilli present in fairly numerous clumps, one very large globus. Both forms of amœbæ very numerous. Cholera bacilli numerous.
2. Acid-fast bacilli present, a few small clumps. Both forms of amœbæ numerous. Cholera bacilli very numerous.
3. Acid-fast bacilli present, numerous clumps and scattered bacilli. Both forms of amœbæ present. Cholera bacilli present.
4. Acid-fast bacilli present, a few clumps and scattered bacilli. Both forms of amœbæ present. Cholera bacilli scanty.
5. Acid-fast bacilli present, a few scattered small clumps. Both forms of amœbæ present. Cholera bacilli very numerous.

In the subcultures which were prepared from the emulsion subcultures (Case No. 38) the results were:

1. Acid-fast bacilli absent. Both forms of amœbæ present, vegetative forms very numerous. Cholera bacilli very numerous.
2. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli present.
3. Acid-fast bacilli absent. Both forms of amœbæ present, vegetative forms very numerous. Cholera bacilli numerous.
4. Acid-fast bacilli absent. Both forms of amœbæ numerous. Cholera bacilli numerous.
5. Acid-fast bacilli absent. Both forms of amœbæ numerous. Cholera bacilli numerous.

Examination of sixth subcultures.

In the subcultures which were prepared with the nodules from Case No. 37, the results were:

1. Acid-fast bacilli present, numerous large clumps. Both forms of amœbæ numerous. Cholera bacilli present.
2. Acid-fast bacilli present, numerous clumps. Both forms of amœbæ present, but vegetative forms few. Cholera bacilli present.
3. Acid-fast bacilli present, a few small clumps. Both forms of amœbæ present, but motile forms few. Cholera bacilli plentiful.
4. Acid-fast bacilli present, clumps and scattered bacilli. Both forms of amœbæ present, cysts plentiful. Cholera bacilli present.
5. A few acid-fast bacilli present. Both forms of amœbæ present. Cholera bacilli present.

In the subcultures which had been prepared from emulsion-subcultures (Case No. 37), the results were:

1. Acid-fast bacilli absent, only amœbæ cysts present. Cholera bacilli few.
2. A few acid-fast bacilli present. Both forms of amœbæ present, but vegetative forms few. Cholera bacilli scanty.
3. Acid-fast bacilli absent. Both forms of amœbæ present, cysts numerous. Cholera bacilli very numerous.
4. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli present.
5. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli present.

In the subcultures which had been prepared with nodules from Case No. 38, the results were:

1. Acid-fast bacilli present, a few small scattered clumps. Both forms of amœbæ present. Cholera bacilli present.
2. Acid-fast bacilli present, a few small scattered clumps. Both forms of amœbæ present. Cholera bacilli present.

3. Acid-fast bacilli present, two or three small groups, only amœbæ cysts present. Cholera bacilli very numerous.
4. Acid-fast bacilli present, a very few small clumps. Both forms of amœbæ present but vegetative forms scanty. Cholera bacilli present.
5. Acid-fast bacilli present; a very few small clumps. A few amœbæ cysts present. Cholera bacilli scanty.

In the subcultures prepared from the emulsion-subcultures the results were:

1. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli present.
2. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli present.
3. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli present.
4. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli present.
5. Acid-fast bacilli absent. Both forms of amœbæ present. Cholera bacilli present.

The sub-cultures in this series in which acid-fast bacilli were found, that is those prepared with nodules of tissue, were heated for half an hour at 60°C. Clegg states that by so doing the amœbæ and cholera bacilli are killed, but that the leprosy bacilli are unaffected.

Subcultures were prepared from the heated cultures and incubated for one week at 37°C. No growth of acid-fast bacilli was obtained but there was some proliferation of the amœbæ. Thus by following in detail the directions given by Clegg we have failed to obtain a culture of the leprosy bacillus. As has been observed in every one of our experiments, there was persistence but no evidence of proliferation.

		2nd sub-cultures.	3rd sub-cultures.	4th sub-cultures.	5th sub-cultures.	6th sub-cultures.	
Case No. 37.	1	+	+	+	+	+ +	
	2	+	+	+	+	+ +	
Nodules of	3	+	+	+	+	+	
leper tissue.	4	+	+	+	+	+	
	5	+	+	+	+	+	
Case No. 37.	1	—	—	—	—	—	
	2	+ +	+	+	+	+	On these tubes there was a nodule of leper tissue.
Emulsion of	3	—	—	—	—	—	
leper tissue.	4	—	—	—	—	—	
	5	—	—	—	—	—	
Case No. 38.	1	+	+	+	+	+	
	2	+	+	+	+	+	
Nodules of	3	+	+	+	+	+	
leper tissue.	4	+	+	+	+	+	
	5	+	+	+	+	+	
Case No. 38.	1	—	—	—	—	—	
	2	+	—	—	—	—	
Emulsion of	3	—	—	—	—	—	
leper tissue.	4	—	—	—	—	—	
	5	—	—	—	—	—	

Experiments with Carrel's Medium.

Carrel, in a series of papers published in the *Journal of Experimental Medicine*, has described the technique by which the cultivation of tissues *in vitro* may be accomplished. Connective tissue, he states, can be successfully cultivated, and as the leprosy bacilli with which we are working is contained in connective tissue, it was considered possible that by this procedure a culture of the *bacillus lepræ* might be obtained.

The leper tissue was obtained on the 9th September, 1913, from a nodule on the upper part of the left ear of a case of nodular leprosy (Case No. 39). Smears

prepared from a portion of this tissue showed the presence of enormous numbers of leprosy bacilli.

The tissue was cut into small pieces. Two dishes were inoculated direct with these small pieces and a third dish was inoculated with a suspension of them in Ringer's fluid. The dishes were of the type devised by Gabritschewski, and the medium was human plasma diluted with two-fifths its volume of sterile distilled water. The peripheral portion of the lower plate received sterile distilled water, and the plates were sealed with vaseline. Incubation was carried out at 38°C. Carrel has stated that the life of a tissue *in vitro* is very short; he has devised methods by which this life can be prolonged, and these methods we have employed.

After incubation it was noted that each nodule was surrounded by a hyaline area which contrasted sharply with the turbid coagulated plasma. On examination under a low-power (the only one possible on account of the thickness of the dish-covers) there was no evidence of outgrowths from the nodules. The hyaline areas were caused by liquefaction of the plasma.

On the 13th September, the nodules were removed from the Gabritschewski's dishes to plates containing Ringer's fluid and placed in the ice-box.

The liquefied areas were not apparently contaminated—at least, smears prepared from these areas did not show the presence of contaminating micro-organisms. The liquefaction must, therefore, be attributed to the nodules of tissue, but whether due to the tissue or to the acid-fast bacilli it is impossible to say.

When the nodules had been for one and a quarter hour in Ringer's fluid at a temperature of 0°C. they were re-inoculated on to dilute plasma spread on Gabritschewski's dishes and again incubated at 38°C.

After incubation no hyaline areas were observed round the nodules, and there was no apparent liquefaction of the medium. On the 18th September, the nodules were again transferred to Ringer's fluid and washed in it for one hour at 0°C. After which they were re-inoculated on to dilute plasma and incubated at 38°C. On incubation, the three plates showed minute whitish spots, and it was suspected that contamination had occurred.

On the 24th September the nodules were removed and washed in Ringer's fluid for one hour and twenty minutes at 0°C. Films were then prepared from the whitish spots and no micro-organisms were found. After washing, the nodules were re-inoculated on dilute plasma and incubated as before.

On the 29th September the nodules were washed for two and a half hours and then re-inoculated.

The experiment is still in progress. Films were prepared from each of the Gabritschewski's dishes, but in no instance has evidence been obtained of proliferation of the acid-fast bacilli and none of the plates were contaminated.

Experiments on Animals.

The following additional experiments have been carried out:—

On the 24th June a rabbit (No. 21) was inoculated in the anterior chamber of the right eye with a piece of leper tissue, which had been removed three hours previously from a case of nodular leprosy (Case No. 33). Another piece of the same leper tissue was heated for twenty minutes in the autoclave at 120°C. and then inoculated into the anterior chamber of the right eye of a rabbit (No. 22). On the same day a rabbit (No. 23) was inoculated in the anterior chamber of the right eye with a piece of leper tissue which had been removed three hours previously from a case of nodular leprosy (Case No. 34). Two other pieces of the same tissue were heated for twenty minutes in the autoclave at 120°C. and then inoculated as before in the right eyes of two rabbits (Nos. 24 and 25).

On the 10th July a piece of leper tissue was excised from a nodule situated in the right lumbar region of a case of nodular leprosy (Case No. 35) and divided into small pieces. Each of the three guinea-pigs (Nos. 26, 27 and 28) received one of these portions in the anterior chamber of the right eye. On the same day a large piece of leper tissue was excised from a case of nodular leprosy (Case No. 36) and emulsified in salt solution. Three male guinea-pigs (Nos. 29, 30 and 31) each received into the left testicle about 1 c.c. of the emulsion. The leper tissue used on this occasion contained but few bacilli, so few, indeed, that we failed to find them in the emulsion prepared from it. In all the other experiments the material employed contained vast numbers of acid-fast bacilli.

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On the 9th September a large piece of leper tissue was obtained from a case of nodular leprosy (Case No. 39) and emulsified in salt solution. The emulsion was rich in leprosy bacilli. The guinea-pigs (Nos. 17, 18, 20, 29, 30, and 31) were each re-inoculated in the left testicle with 0.5 c.c. of the emulsion. Three rabbits (Nos. 32, 33 and 34) each received an intraperitoneal inoculation of 0.5 c.c. of the emulsion, and three rabbits (Nos. 35, 36 and 37) each received an injection into the left testicle of 0.5 c.c. of the emulsion.

Each experimental animal is confined in a separate cage. It is intended that the animals shall be kept under observation until death occurs. Up to the present it has only been found necessary on one occasion to depart from this arrangement, and that was in the case of a rabbit (No. 13). On the 11th March this animal had been inoculated in the anterior chamber of the right eye with a piece of leper tissue. On the 10th April it was observed that a prolapse had occurred at the site of the incision through which there protruded a fungating mass measuring 4 m.m. in length by 3 m.m. in breadth. The animal was therefore killed.

Number of Experiment.	Animal.	Date of inoculation.	Site of inoculation.	Material inoculated.	Interval between removal from body and inoculation.	Patient's number.	Remarks.
1	Rabbit	27 December, 1912	Anterior chamber of right eye	Portion of leproma	1 hour	24	——
2	Rabbit	27 December, 1912	,, ,,	,, ,,	,,	24	——
3	Gibbon F.	22 August, 1912	Supraorbital region	Emulsion of juice expressed from erythematous patch	½ hour	20	Reinoculated 27 December, 1912, in right supraorbital region with portion of leproma from case 24. Died 21 January, 1913.
4	Wild rat	27 December, 1912	Root of tail	Portion of leproma	1½ hours	24	Died 28 December, 1912. Trypanosomiasis.
5	Wild rat	27 December, 1912	,, ,,	,, ,,	,,	24	Died 4 September, 1913
6	Rabbit	7 March, 1913	Anterior chamber of right eye	,, ,,	24 hours	28	Died 11 June, 1913.
7	Rabbit	7 March, 1913	,, ,,	,, ,,	½ hour	29	——
8	Rabbit	7 March, 1913	,, ,,	,, ,,	¼ hour	30	——
9	Rabbit	7 March, 1913	,, ,,	,, ,,	2 hours	30	——
10	Rabbit	11 March, 1913	,, ,,	,, ,,	1⅓ hours	31	——
11	Rabbit	11 March, 1913	,, ,,	,, ,,	1½ hours	31	Died 11 a.m., 30 June, 1913.
12	Rabbit	11 March, 1913	,, ,,	,, ,,	2 hours	31	——
13	Rabbit	11 March, 1913	,, ,,	,, ,,	,,	31	Fungating growth noted at site of incision, 10 April, 1913, rabbit killed.
14	Rat M.	11 March, 1913	Scrotum	,, ,,	2¼ hours	31	——
15	Rat F.	11 March, 1913	Root of tail	,, ,,	2½ hours	31	Died 10.50 a.m., 10 September, 1913.
16	Rat F.	11 March, 1913	,, ,,	,, ,,	3 hours	31	Found dead in cage, 30 June, 1913.
17	Guinea-pig M.	12 March, 1913	Scrotum	,, ,,	1 hour	32	Reinoculated 9 September, 1913, in left testicle, with 0.5 c.c. of emulsion rich in leprosy bacilli from case 39.
18	Guinea-pig M.	12 March, 1913	Tunica vaginalis	,, ,,	,,	32	Reinoculated 9 September, 1913, as in case 17
19	Rabbit	12 March, 1913	Anterior chamber of right eye	,, ,,	1¼ hours	32	Died 21 April, 1913. Coccidiosis.
20	Guinea-pig M.	12 March, 1913	Tunica vaginalis	,, ,,	1½ hours	32	Reinoculated 9 September, 1913, as in case 17.
21	Rabbit	24 June, 1913	Anterior chamber of right eye	,, ,,	3 hours	33	——

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Number of Experiment.	Animal.	Date of inoculation.	Site of inoculation.	Material inoculated.	Interval between removal from body and inoculation.	Patient's number.	Remarks.
22	Rabbit	24 June, 1913	Anterior chamber of right eye	Portion of leproma which had been heated 20 minutes at 120°	4 hours	33	Died 6 September, 1913.
23	Rabbit	24 June, 1913	,, ,,	Portion of leproma	3 hours	34	——
24	Rabbit	24 June, 1913	,, ,,	Portion of leproma which had been heated 20 minutes at 120°	4 hours	34	——
25	Rabbit	24 June, 1913	,, ,,	,, ,,	,,	34	——
26	Guinea-pig M.	10 July, 1913	,, ,,	Portion of leproma	1 hour	35	——
27	Guinea-pig M.	10 July, 1913	,, ,,	,, ,,	1½ hours	35	——
28	Guinea-pig M.	10 July, 1913	,, ,,	,, ,,	3 hours	35	——
29	Guinea-pig M.	10 July, 1913	Left testicle	Emulsion of leproma	2 hours	36	Reinoculated 9 September, 1913, as in case 17.
30	Guinea-pig M.	10 July, 1913	,, ,,	,, ,,	,,	36	,, ,, ,,
31	Guinea-pig M.	10 July, 1913	,, ,,	,, ,,	,,	36	,, ,, ,,
32	Rabbit F.	9 September, 1913	Intraperitoneal inoculation	½ c.c. of emulsion rich in leprosy bacilli	3 hours	39	——
33	Rabbit M.	9 September, 1913	,, ,,	,, ,,	,,	39	——
34	Rabbit M.	9 September, 1913	,, ,,	,, ,,	,,	39	——
35	Rabbit M.	9 September, 1913	Intratesticular inoculation L	,, ,,	,,	39	——
36	Rabbit M.	9 September, 1913	,, ,,	,, ,,	,,	39	——
37	Rabbit M.	9 September, 1913	,, ,,	,, ,,	,,	39	——
38	Rabbit F.	18 September, 1913	Anterior chamber of right eye	Piece of normal subcutaneous tissue	1 hour	—	——
39	Rabbit M.	18 September, 1913	,, ,,	,, ,,	,,	—	——

As regards the animals which have died, in addition to those previously recorded, rabbit No. 19 died of coccidiosis on the 21st April, that is, forty days after inoculation; rabbit No. 22 died on the 6th September, that is, seventy-four days after inoculation; rabbit No. 6 died on the 11th June, that is, ninety-six days after inoculation; rabbit No. 11 died on the 30th June, that is, one hundred and eleven days after inoculation; rat No. 16 died on the 30th June, that is, one hundred and eleven days after inoculation; rat No. 15 died on the 10th September, that is, one hundred and eighty-three days after inoculation; rat No. 5 died on the 4th September, that is, two hundred and fifty days after inoculation.

In the case of every dead animal a detailed examination has been made. In no instance have we been able to convince ourselves that multiplication of the acid-fast bacilli has occurred, and in no instance has dissemination of the organisms been found.

A Suggestion.

At the Seventeenth International Congress of Medicine, the question of the cultivation of the *bacillus lepræ* formed the subject of a discussion. From the report of the proceedings it is to be inferred that no satisfactory conclusion was reached, a result attributable in part to the inherent difficulties of the problem and in part to the paucity of investigators present who had had practical experience of the

subject. I am convinced that it is impossible for those who have not worked at the cultivation of the *bacillus lepræ* to express an opinion of value.

As regards the investigators, Duval frankly admitted that he had been mistaken. Bayon asserted that he was right and that Rost was wrong. Rost naturally defended his work and found fault with that of Bayon. Clegg made no communication to the Congress, neither did Kedrowski; and Twort's work has not advanced beyond a preliminary communication to the Royal Society.

The work done here has not confirmed the findings of investigators. We do not consider that our results are conclusive, but we are of opinion that the present position is a hopeless one and can only create an endless series of fruitless discussions.

Those who are acquainted with the clinical aspects of leprosy must be familiar with the terrible condition of the afflicted. Leprosy is common in, but is not confined to, tropical countries, and is the most important tropical disease on which the least satisfactory progress has been accomplished. We therefore suggest that steps might be taken by the Tropical Diseases Research Committee with a view to the organization of an international commission composed of the various investigators who have worked at this disease. It may be found to be impracticable, but it is worthy of trial, and I know of no other scientific body which could more fittingly initiate the work.

Nothing can be accomplished by mere comparison and examination of the various cultures claimed to be those of the *bacillus lepræ*. If the various investigators were induced to meet in a place where there are numbers of lepers and suitable facilities for research and each of them afforded an opportunity to repeat his work, then it might be possible to remove the existing mass of inconsistencies beneath which there may be a substratum of fact.

It may be contended that the question of finance alone makes the proposal a prohibitive one, but in a matter of such importance that difficulty could surely be overcome.

A central place would no doubt be selected for the work. In this country the most excellent facilities are already in existence, and we believe that the Government of the Federated Malay States would assist in every way possible.

Parasitology.

Dr. Stanton furnishes the following report:—

Studies of the larval and pupal stages of Anopheles, Stegomyia and other genera of mosquitoes have been continued. Specimens bred from ova laid by females in captivity have formed the basis of this study, and it is hoped by this means to avoid those inaccuracies which are liable to result in the absence of such experimental work. The larval forms not hitherto described of the following species have thus been dealt with:—*Anopheles tessellatus*, Theobald; *Anopheles kochi*, Dönitz; *Stegomyia nivea*, Ludlow; *Skeiromyia fusca*, Leicester; *Tæniorhynchus* (*culex*) *ager*, Giles; *culex mimeticus*, Noe.

At the suggestion of the Director of the Imperial Bureau of Entomology data have been collected as to the distribution of the various species of *Stegomyia* in this and neighbouring countries. It is considered that this information will be of value in connexion with any measures which it may be decided to undertake to prevent the spread of yellow fever to the Orient.

The larvæ of the three common species of *Stegomyia* in this country, *fasciata*, *scutellaris*, and *nivea* have been studied in detail. It has been found that the characters usually given by authors for the differentiation of species of larvæ in the *Stegomyia* group are practically valueless for this purpose. In the mature larvæ of this group, as in *Anopheles*, the form and arrangement of the clypeal hairs and other hairs on the dorsum of the head afford a ready and reliable means of identifying the species. Details of these observations will be given in a later report.

The genus Phlebotomus (*sand flies*), members of which have been shown in India and elsewhere to be transmitting agents of dengue-like fevers, is found to be represented in Malaya by at least one species, namely, *Phlebotomus perturbans*, Meijere. This is the first record of *Phlebotomus* in the Malay Peninsula.

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Specimens of mosquitoes and biting flies and other insects have been sent to the King Institute, Madras, the London School of Tropical Medicine, the British Museum, and the Imperial Bureau of Entomology. Besides the Federated Malay States material has been received for identification from Kelantan, the Straits Settlements, and Borneo.

Anopheles and malaria in the Oriental region.

Dr. Stanton has continued his researches on this subject and furnishes the following report:—

Though the anopheles factor is only one in a complex of conditions which result in severe or epidemic malaria, it is happily one that is open to attack by public measures. It is of high importance, therefore, that we should be acquainted with the species of anopheles, their relationship to man and to those parasites of man which they transmit.

This study has been much hampered by the uncertain state of nomenclature in the group. It has been found, on the one hand, that identical mosquitoes are known under different names in different countries, and on the other hand that different mosquitoes are known under the same name. This question of accuracy or at least uniformity in nomenclature of species is of importance to the sanitarian, for it is probable that the same or similar species will be found to have similar habits and habitat in whatever country they are found, and so the knowledge gained of malaria-carrying species in one country can be turned to account in others.

Some attempt in the direction of this uniformity has already been made by James and myself, in regard to India and the Malay Peninsula, and lately, through the courtesy of Dr. Schuffner, in regard to Sumatra and the Malay Peninsula. The inclusion of Indo-China, the Philippine Islands, Formosa, and other countries in a scheme for the systematic study of Oriental species of anopheles would, I am convinced, do much to advance knowledge and thereby to increase the effectiveness of preventive measures against malaria.

In the record of anopheles from the Malay Peninsula thirty-five species-names occur in the literature, but not more than eighteen of these are of valid species which exist in that area. In the following lists I give: (I.) the names of those Malayan species which are now regarded as valid; (II.) the species-names occurring in the literature which are regarded as synonyms; (III.) the names of those valid species which are believed to have been erroneously recorded from the Malay Peninsula.

I. *Valid species.*

aitkeni, James.
albirostris, Theobald.
albotaeniatus, Theobald.
aurirostris, Watson.
asiaticus, Leicester.
barbirostris, Van der Wulp.
fuliginosus, Giles.
kochi, Dönitz.
leucosphyrus, Dönitz.
ludlowi, Theobald.
maculatus, Theobald.
nigrans, Stanton.
rossi, Giles.
sinensis, Wied.
tessellatus, Theobald.
umbrosus, Theobald.
watsoni, Leicester.
wellingtonianus, Alcock.

II. *Synonyms.*

annularis, Van der Wulp.	=	*sinensis*, Wiedemann.
elegans, James.	=	*leucosphyrus*, Dönitz.
fragilis, Theobald.	=	*aitkeni*, James.
halli, James.	=	*kochi*, Dönitz.
karwari, James.	=	*nigrans*, Stanton.
leucophyrus, Leicester.	=	*leucosphyrus*, Dönitz.
minutus, Theobald.	=	*sinensis*, Weidemann.
nivipes, Theobald.	=	*fuliginosus*, Giles.
ocellatus, Theobald.	=	*kochi*, Dönitz.
peditœniatus, Leicester.	=	*sinensis*, Weidemann.
separatus, Leicester.	=	*sinensis*, Weidemann.
preacherii, Leicester.	=	*aitkeni*, James.
vanus, Walker.	=	*sinensis*, Weidemann.

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III. *Errors in identification.*

listoni, Liston	for	*albirostris*, Theobald.
punctulatus, Dönitz	for	*tessellatus*, Theobald.
willmori, James	for	*maculatus*, Theobald.

A few words with reference to those species which are common to Sumatra and Malaya may not be inopportune. Professor Dönitz was engaged in describing the anopheline fauna of Sumatra and Java at about the same time that Mr. Theobald was engaged on that of Malaya. The consequence was that many species now known to be identical were described under different names. English-speaking workers in India and elsewhere have for the most part adopted the nomenclature of Mr. Theobald, in some cases neglecting the fact that Professor Dönitz's descriptions were published first. I have recently had the opportunity of examining some of Dönitz's preparations preserved in the British Museum and of comparing Malayan with Sumatran specimens.

I find, for example, that Dönitz *Anopheles kochi* is identical with the species known as *Christophersia halli* in India, and which James and I found to be identical with Malayan specimens. Theobald considered that the peculiar position of the abdominal scale tufts in this species warranted the creation of a new species and a new genus for its reception. Dönitz's description of *kochi* is, however, perfectly clear on this point. He notes that the scale tufts lie ventrally and diverge from the middle line. The correct name for this species is therefore *kochi*, Dönitz. Similarly *elegans*, James, is identical with *leucosphyrus*, Dönitz; *leucopus*, Dönitz, and *nivipes*, Theobald, are identical with *fuliginosus*, Giles; *deceptor*, Dönitz, with *tessellatus*, Theobald; while *aconitus*, Dönitz, is very near, if not identical with, Theobald's *albirostris*.

Records of malaria infection in anopheles.

James enumerates the following species as proved carriers of malaria in India: *culicifacies*, Giles; *fuliginosus*, Giles; *listoni*, Liston; *maculipalpis*, James and Liston; *stephensi*, Liston. To this list must be added the species *willmori* found infected by Mrs. Adie in the Kangra valley.

Christophers states that in the Andamans *ludlowi* is the carrier of malignant malaria.

From Sumatra Schuffner (1902) has reported that he has observed the development of malaria parasites in an anopheline species referred to by him as Anopheles I. and which Eysell claims to be *rossi*. De Vogel (1910) also reports the successful infection of *rossi* bred from salt water pools.

From Formosa, Miyajima and Kinoshita have recorded that *listoni* and *annulipes* are carriers of malignant malaria and *sinensis* of benign tertian. Tsuzuki found a species which he refers to as *A. formosœnsis* to be a carrier.

In the Federated Malay States Leicester has reported negative results in feeding experiments with *rossi*, *sinensis*, and *barbirostris*. Watson has recorded *willmori*, *karwari*, and *umbrosus X* as carriers; he notes that he found both zygotes and sporozoites in *willmori*, but the details of observations or experiments with other species are not given. James and I have recorded natural and experimental infection in the species *albirostris*. I have found *maculatus*, *fuliginosus*, and *sinensis* naturally infected, and have observed the development of the parasites of malignant malaria in *albirostris*, *fuliginosus*, and *maculatus*.

Having thus cleared the way by a statement of the recorded instances of malaria infection in anopheles, the evidence on which the claims of authors are based may now be reviewed.

The listoni group.

The three species and *listoni*, *culicifacies*, *albirostris* may conveniently be taken together. The first two have been shown by several observers, Stephens and Christophers, James and others to be important agents in the spread of malaria in India. The species *listoni* is also stated to occur in Indo-China and Formosa, and in these countries also has been found to be a very dangerous species.

Major James and I reported at the last meeting of the Far Eastern Association of Tropical Medicine that the parasites of malignant tertian malaria readily undergo development in the species *albirostris* and that we had found this species infected in nature.

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Of seventy-eight specimens of *albirostris* taken in nature three were found to be infected. Of twenty-two specimens fed on blood containing malignant tertian gametocytes nine were found infected. In one specimen which had fed several times, more than two hundred zygotes were counted. Zygotes developed up to full maturity but the completed cycle with sporozoites in the salivary gland was not observed. Major Lalor has reported finding sporozoites in the salivary glands of a specimen of *listoni var. alboapicalis* in Burmah—this species is, I believe, *albirostris.*

Tsuzuki's *A. formosœnsis,* which he found to be a carrier in Formosa, is said by Dönitz to be only a variety of his *aconitus.* As I have already said, this species is probably identical with Malayan *albirostris. Albirostris* possesses the distinctive character of absence of flecking on the third long vein which Dönitz laid stress upon as diagnostic of his *aconitus,* and in other features it closely corresponds to *aconitus.*

Albirostris has also been reported from Calcutta and the Andaman Islands under the name of *brahmacharii.* I have also examined specimens taken in Burmah.

The "Nyssorhynchus" group.

Anopheles fuliginosus.—First incriminated as a malaria-carrier by Stephens and Christophers. Adie found sporozoites in the salivary glands of specimens taken in the Punjab.

It is a common species in the Malay Peninsula, where it has been known as *nivipes.* Comparison of Malayan *nivipes* with Indian *fuliginosus* has shown that they are the same species. Christophers, however, prefers to regard the Andamans type as a variety of *fuliginosus.*

Its larvæ are common in pools and lakes with weedy margins.

In my experiments with this species, of twenty-three specimens taken in nature one showed zygotes, and of ten fed on blood containing gametocytes of malignant tertian malaria, two developed zygotes.

Anopheles maculatus.—A common species in India and the Malay Peninsula, originally described from specimens taken in Hong Kong. It occurs also in Sumatra and Formosa.

It has been redescribed by Leicester from the Malay States under the name *willmori. Maculatus* and *willmori* are, however, two distinct species. In examining the type specimens of the species *maculatus* in the British Museum, I found that the male and female types were of two different species, the male only being of the species usually known to students of the Oriental group as *maculatus.* In this circumstance lies the explanation of the confusion which has existed regarding the nomenclature of this and closely allied forms.

It was proved to be a carrier by Watson in the Federated Malay States, who showed also that it was associated with severe malaria in hilly country.

In my experiments, of 32 specimens taken in nature and dissected, two were infected, and of seven specimens fed on blood containing malignant tertian gametocytes, one developed zygotes.

The species *maculipalpis, willmori,* and *stephensi,* which also belong to the "Nyssorhynchus" group, have been proved to be carriers in India. What relationship *annulipes* of Formosa bears to other Oriental species, I have been unable to determine.

The species umbrosus and sinensis.

Anopheles umbrosus.—This species has been found infected in nature by Watson in the Federated Malay States, but the details of his observations have not been published. I am informed by Colonel Alcock that *umbrosus* has also been found infected in Borneo. In my own experiments six dissections and five feeding experiments were negative.

Anopheles sinensis.—Tsuzuki has shown that this species, referred to by him as *A. jesœnsis* is a carrier of benign tertian malaria in Japan. Kinoshita also in Formosa found it to be a carrier of benign tertian and quartan, but not of malignant tertian malaria.

In eighty-seven dissections I found two specimens infected with full-grown zygotes—the species of parasite could, therefore, not be determined. In eleven specimens fed on crescent-containing blood none developed zygotes.

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The rossi group.

I come now to the consideration of a group of anopheles about which there has been much argument—the *rossi* group. The three types *rossi*, *indefinatus*, and *ludlowi*, which are variously regarded by some as a single species, by others as one species and two varieties, and by others as three distinct species, are obviously closely related. One or other of them is a common species in every country of the Oriental region. What part do they play in malaria transmission?

In India the work of many competent observers over a series of years warrants the conclusion that *rossi* as there defined is not a carrier. Bentley, from his extensive investigation in Bombay, concludes that this species is naturally refractory to malaria infection.

The commonest type of *rossi*-like anopheles in the Malay Peninsula is that species or variety known as *indefinatus*. It differs slightly from typical Indian *rossi* in the palpal markings. One hundred and fourteen dissections of the mid gut and salivary glands of Malayan specimens taken in nature showed no infected individuals, and of twenty-two specimens fed on blood containing numerous crescents none became infected. It seems improbable, therefore, that this variety of *rossi* is a carrier in the Malay Peninsula.

Eysell cites Kinoshita, Banks, De Vogel, and Schuffner in support of his contention that *rossi* is an important agent in the transmission of malaria. His citation of Kinoshita is an error, as *rossi* was not one of the species which that author found to carry malaria in Formosa. Banks experimented with the species *ludlowi*, though he afterwards concluded that this species was identical with *rossi*; his description has been held to suggest doubts as to the nature of the bodies which he believed to be malaria parasites. DeVogel says that he was able to infect only specimens which had bred from salt water. It is now known that *ludlowi* breeds by preference in such situations, and it has been suggested that it was with this species that DeVogel dealt. Schuffners' anopheles I., Eysell says, is identical with *vagus*, Dönitz, and, therefore, with *rossi*, Giles.

Major Christophers, working in the Andamans, records finding two infected specimens of *ludlowi* out of fifty-three examined, and from his study of the conditions there concludes that "the chief carrier of malaria in the settlement is *ludlowi*, a species which breeds in and about salt swamps."

It must be admitted that the evidence with regard to these *rossi*-like mosquitoes is very unsatisfactory, and as they are common species everywhere in the Orient their relationship to malaria is deserving of further study.

In addition to the species dealt with above, I have carried out experiments with the following species with negative results.

	Dissections.	Feeding Experiments.
Nigrans	20	—
Barbirostris	16	8
Kochi	7	4

This survey of what is known of the distribution of anopheles in the Oriental region, and of their relationship to malaria, reveals the fact that the most important agents in the spread of malignant malaria are that group of small brown anopheles which includes *listoni*, *culicifacies*, and *albirostris*. These are hardy species, voracious blood-suckers, and intimate in their association with man. Next in general importance is the "Nyssorhynchus" group, which comprises *maculatus*, *fuliginosus* and *stephensi*. The part played by such species as *ludlowi*, *sinensis*, and *umbrosus* is less clearly defined and seems to warrant further inquiry.

Blackwater fever.

Dr. Fletcher has continued his researches on this disease, and furnishes the following report:—

Eight cases of blackwater fever were reported during the six months under consideration. Where it was possible these cases were visited and the urine and blood examined.

The subjoined table, in which are set out the main features of these cases, is followed by accounts of them in greater detail.

Serial letter	Date.	Age.	Nationality.	Place.	Occupation.	Previous attack of blackwater.	History of malaria.	History of quinine.	Quinine immediately.	Amount of urine.	Treatment.	Result.	Remarks.
N	4 April 1913	20	Tamil	Tanjong Malim, Perak	Rubber estate	—	Twice during month of attack	Quinine, grains five daily	Grains five as usual	Plentifu	Quinine in large doses	Urine cleared 3rd day. Recovered	
O	21 May 1913	26	European	Seremban, Negri Sembilan	Rubber estate	—	Only once during 3 months previous to attack. Before that much fever.	Took quinine irregularly	?	Scanty	Quinine in large doses	Died	
P	2 August 1913	30	European	Gopeng, Perak	Tin mine	One, nine months before	Very frequent attacks	No quinine	None	Admitted unconscious and died soon afterwards	—	Died	No quinine taken before the attack.
Q	7 August 1913	32	Malayalum	Raub, Pahang	Rubber estate	One, three years before	Only one attack in last three years. Frequent before	No quinine	None	Plentiful	Quinine in large doses	Urine cleared 4th day. Recovered	No quinine taken before attack.
R	8 August 1913	42	Chinese	Seremban, Negri Sembilan	Rubber estate	—	Very frequent attacks	Took quinine irregularly	Grains thirty the day before the attack	Plentiful	Quinine in large doses	Urine cleared 4th day. Recovered	
S	6 September 1913	37	Chinese	Rembau, Negri Sembilan	Goldsmith	—	Frequent attacks	Took quinine whenever he had fever	Grains ten shortly before the attack	?	Quinine in large doses	Urine cleared 6th day. Recovered	
T	19 September 1913	30 (?)	European	Kuala Selangor, Selangor	Rubber estate	One, two years before	Frequent attacks	Took grains fifteen daily	Quinine as usual	Plentiful	Quinine grains fifteen daily	Urine cleared 6th day. Recovered	
U	21 September 1913	26	Chinese	Seremban, Negri Sembilan	Shop (carpenter)	—	Frequent attacks	Took quinine irregularly	Grains ten intra-muscular 3 hours before attack	Plentiful	Quinine in large doses	Urine cleared in twenty-four hours. Recovered	Subtertian rings were found in the blood on the day before the attack.

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In two of the cases, P and Q, quinine is excluded as an exciting cause of the disease. All the patients, excepting one who died very soon after admission, and another who received only fifteen grains daily, were treated with large doses of quinine, that is to say, twenty grains or more daily, and of the cases so treated only one died.

In case U subtertian rings were found in the blood on the day before the attack, but none were found after the onset of the blackwater. All the patients, except possibly Case N, had suffered from severe malaria for many months or for several years, though two of them had been comparatively free from it for some time before the attack of blackwater. Three of them had suffered from a previous attack of blackwater fever. There was a relative increase in the numbers of the large mononuclear leucocytes in all the cases, the average number being 14.5 per cent.

Oxyhæmoglobin was present in the urine of every case. Methæmoglobin, in small quantities, was recognised in three.

Clinical details of Cases.

N. April 4th, 1913.

A Tamil coolie, aged 20 years, from the Tanjong Malim Rubber Estate at Tanjong Malim in Perak.

This man had suffered twice from "fever" during the two months prior to his attack of blackwater. He was in the habit of taking five grains of quinine daily as a prophylactic.

When seen, he had been suffering from blackwater fever for two days. He was anæmic and jaundiced, and his spleen was enlarged. The urine at this time was the colour of claret; it contained a small amount of amorphous blood debris, uric acid crystals and a little albumen. No casts were seen. The patient was passing a fair quantity of urine. Spectroscopic examination showed the presence of oxyhæmoglobin and a small quantity of methæmoglobin.

This patient was treated with bihydrochloride of quinine, three grains every three hours. The urine became clear on the third day, and he recovered.

O. May 21st, 1913.

A European, planter, aged 26 years, from a rubber estate (Bute) in Negri Sembilan. He had suffered frequently from malaria for several years in Assam, in Johore, and in Malacca, before he came to Negri Sembilan three months prior to his attack of blackwater fever. He was in the habit of taking quinine fairly regularly, and during the last three months he had had only one attack of fever.

Five days before his urine was examined at this Institute he had a rigor, and shortly afterwards passed very dark urine. Two days later, when he was admitted to the Seremban hospital, he was passing a small amount of bloody urine; he was very restless and vomited almost incessantly. Over his abdomen, shoulders, and elbows there were dark purpuric blotches. He was treated with intramuscular injections of quinine and also received injections of normal saline solution and horse serum. This case terminated fatally.

A spectroscopic examination of the urine demonstrated the presence of oxyhæmoglobin. The deposit was composed of blood debris, bacteria, and numerous desquamated cells.

No parasites were found in the blood smears. The white cells were in the following proportions:—

Polymorphonuclears	54
Small lymphocytes	30
Large mononuclears	14
Eosinophiles	1
Mast cells	1

P. August 2nd, 1913.

A European miner, aged 30, from Gopeng in Perak. This patient had suffered a great deal from subtertian malaria and he drank alcohol to excess. He had a previous attack of blackwater eight months before. He was not in the habit of taking quinine and he had been suffering from fever for some time when he suddenly became unconscious while at work. On the following day he was admitted to Batu

Gajah hospital in a condition of delirium, and he died about twenty-four hours later. A sample of urine, taken on the day of his admission to hospital, was of a dark mahogany colour. It contained a small quantity of oxyhæmoglobin. There was a copious deposit, consisting of blood-debris, hæmatoidin needles, "hæmoglobin" casts, granular and fatty casts, and a few epithelial cells. The urine showed a cloud of albumen on boiling.

In a sample of urine taken on the following day no hæmoglobin bands could be detected by spectroscopic examination, and no blood debris could be seen in the deposit, which consisted largely of fatty and granular casts, containing a few epithelial cells.

No parasites were found in the blood, which showed a moderate degree of poikilocytosis and the presence of a few nucleated red cells. A differential count of the white cells gave the following result:—

Polymorphonuclears	51
Small lymphocytes	32
Large mononuclears	17
Eosinophiles	0

All the organs received for examination were in an advanced stage of putrefaction, so that sections made from them could not be stained for microscopical examination.

The liver showed a quantity of free iron in the centre of the trabeculæ of the portal zones of the lobules. Towards the middle of the lobules, also in the centre of the trabeculæ, there was pigment of a golden colour. There were abundant granules and lumps of malarial pigment in and near the walls of the capillaries. The liver was so much altered by post-mortem changes that little could be learned from stained sections. The central part of many of the lobules had undergone necrosis with fragmentation of the trabeculæ.

The spleen-pulp was crowded with putrefactive organisms, the nuclei and cells had lost all power of differential staining, and the histological structure of the organ had been destroyed by decomposition. Large blocks and fine granules of malarial pigment were present in abundance.

In the kidney, putrefaction had advanced too far for anything to be learned from sections of that organ.

Q. August 3rd, 1913.

A Malayalum coolie, aged 32, from a rubber estate (Sungei Bulit) in Pahang. He had lived seven years in Pahang, and before that, for three years, he was in Penang and Province Wellesley.

This man had suffered from blackwater fever three years before his present attack, when he was working on another estate (Cheroh). On that occasion his urine was black for ten days. Since that time he had been employed on a more healthy estate and had only once had fever. The first symptom of his present attack was the passing of black urire; two hours later he had rigor and felt feverish. He had taken no quinine before he passed the black urine. On the following day he was admitted into Raub hospital. On the third day of his illness no malarial parasites were found in his blood, but the Medical Officer in charge of the case reports that he found them on the fourth and fifth days of the attack. Blood-smears made on the evening of the fifth day and examined here, contained no parasites.

The white cells were in the following proportions:—

Polymorphonuclears	50
Small lymphocytes	31.5
Large mononuclears	16
Eosinophiles	2.5

The urine became clear at the end of the fourth day. A specimen passed at 3 p.m., and examined here was the colour of porter and contained oxy- and methæmoglobin, hæmoglobin casts, and a few epithelial cells. When boiled the specimen was almost solid with albumen. Urine passed five hours later contained a little less albumen and no blood could be recognized by spectroscopic examination. In a specimen passed at midnight the amount of albumen was slightly reduced, granular casts and degenerate epithelial cells were present, but no blood.

This patient was treated with quinine, thirty grains a day by the mouth, and he was given saline injections. He recovered.

R. August 8th, 1913.

A Chinese coolie, aged 42, from a rubber estate (Gedong Lalang) in Seremban. This man had lived for twenty years in the Malay States, and for some time he had suffered from malaria almost continuously. He took quinine irregularly, and the day before his attack of blackwater began he had taken thirty grains.

The urine and blood of this patient were examined here on the first day of his attack. The urine was a dark port-wine colour; it contained oxyhæmoglobin, a little methæmoglobin, and a deposit which consisted of amorphous blood-debris and a few epithelial cells. On boiling a dense cloud of albumen appeared.

In the blood no parasites were found. A differential count of the white cells gave the following result:—

Polymorphonuclears	74
Small lymphocytes	7.4
Large mononuclears	16.75
Eosinophiles	1.85.

This patient was treated with quinine, thirty grains of the bihydrochloride by intramuscular injection, each day. Calcium chloride and adrenalin were also given. His urine became clear on the fourth day and he recovered.

S. September 6th, 1913.

A Chinese goldsmith from Rembau in Negri Sembilan. This man had suffered from frequent attacks of fever, for which he took quinine irregularly. Three days before his urine was examined here he took ten grains of quinine, and when he next passed water it was black. Two days later he was admitted to the Seremban hospital. No parasites were found in his blood. The slides sent to this Institute were damaged in transit, so that a reliable estimation of the numerical proportions of the white cells could not be made. The urine was almost black. It contained oxyhæmoglobin, "hæmoglobin" casts with a few adherent epithelial cells, and, on boiling, it was almost solid with albumen.

This patient was treated with quinine, twenty grains of the bihydrochloride by intramuscular injection, every day. The temperature became normal and the urine clear on the sixth day.

T. September 19th, 1913.

A European planter, aged about 30, from an estate (Jalan Acob) in Kuala Selangor.

This patient had suffered from frequent attacks of malaria for several years. Two years ago he had suffered from a previous attack of blackwater. During the four weeks immediately preceding his present illness he had been suffering from fever and had been taking ten or fifteen grains of quinine every day, when the attack began with vomiting, diarrhœa, and the passing of black urine.

No parasites were found in his blood. The result of a differential count was as follows:—

Polymorphonuclears	57.72
Small lymphocytes	30.00
Large mononuclears	9.71
Eosinophiles	2.57

The urine examined on the third day of this patient's illness was so dark that it appeared to be black until it had been diluted. It contained oxyhæmoglobin, granular "hæmoglobin" casts with adherent epithelial cells, and a large amount of albumen. The patient was treated with quinine, fifteen grains of the bihydrochloride every day, and saline injections. On the fifth day there was still a cloud of albumen when the urine was boiled, and a trace of oxyhæmoglobin could be detected by spectroscopic examination; there were also a few small casts and some large epithelial cells in the urine. On the following day the urine was clear of hæmoglobin, but there was still a trace of albumen, and granular casts were still present on the eighth day. His illness ended in recovery.

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U. September 22nd, 1913.

A Chinese carpenter, aged 26, from Seremban town. This man had worked on a rubber estate in Singapore, where he had suffered much from malaria. During the five months prior to his present attack he had been living in Seremban, where he had been ill with malaria nearly the whole time, and had taken quinine irregularly. He was admitted to the Seremban hospital on 20th September with a wound on his foot, and during the night he had an attack of fever. His blood was examined, subtertian rings were found and quinine administered. He received an intramuscular injection of ten grains of the bihydrochloride on the afternoon of 21st September, and a second injection the next morning. Three hours after the second dose he passed black urine. The injections of quinine were not discontinued: another dose of ten grains was given four hours after the appearance of the blackwater, and twenty grains were injected during the course of the following day (23rd September). The urine had cleared by the next morning (24th September), within twenty-four hours of the commencement of the attack. One more injection was given and thereafter thirty grains a day by the mouth.

No parasites were found in the blood-smears made on 24th September. White cells were present in the following proportions:—

Polymorphonuclears	60
Small lymphocytes	26
Large mononuclears	13
Eosinophiles	0.5
Mast cells	0.5

A sample of the urine passed on September 22nd was of a dark mahogany colour. Spectroscopic examination showed the presence of oxyhæmoglobin, and there was an abundant sediment of blood-debris containing large "hæmoglobin" casts and a few epithelial cells. This deposit, washed in the centrifuge, contained a trace of iron in organic combination. The urine became solid with albumen when it was boiled.

Wassermann reaction.

For this reaction the method of Browning and Mackenzie was employed, modified by the use of a human hæmolytic system.

Sixteen doubtful or latent cases and four active tertiary cases were examined. Six of the former and all of the latter gave positive reactions.

Widal reaction.

Seventy-two specimens of blood were examined for the presence of agglutinins, with the following results:—

	Positive.	Negative.
B. typhosus	17	51
B. paratyphosus A.	0	2
B. paratyphosus B.	0	2

The very high proportion of negative reactions suggest that Medical Officers tend to make this test a substitute for clinical work.

Rabies.

Examinations were made of the brains of four dogs suspected to have suffered from rabies and Negri's bodies were found in all of them. Two of the cases were sent from Raub in the State of Pahang, one from Kuala Pilah in Negri Sembilan, and one from Malacca.

Plague.

A few rats, fifty-eight in all, were sent from time to time by the Health Officer of Kuala Lumpur. None of them was plague-infected. There were no cases of human plague.

Tumours.

Of the tumours examined, three were uncommon; an epithelioma of the cornea in a Sikh, sent by the Medical Officer of the District hospital, Kuala Lumpur; a primary sarcoma of the ileum, sent by the Medical Officer, Seremban; and a primary sarcoma of the liver which occurred in a Tamil woman, aged 35, and of which the following is a description:—

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On 24th September there were received from the Medical Officer, Kuala Kubu, the liver, spleen, stomach, lung, uterus, heart, and kidney of a Tamil woman aged 35. All these organs had been preserved in a solution of formalin. The uterus and kidney appeared to be normal. The liver was an enormous irregular mass, with irregular bosses on its surface. It weighed 181 ounces. The normal contour of the organ was lost and the limits of its several lobes were no longer definable. The gall-bladder, which was small, shrunken, contained a little bile. The outer parts of the liver were very tough and hard, but the centre had undergone degeneration and was in a pultaceous, encephaloid condition. No traces of liver tissue could be recognized by the naked eye. The organ appeared to consist entirely of new growth, in which there were numerous hæmorrhages and areas of necrotic-softening. In histological sections it was seen that the liver consisted of interlacing bands and whorls of large spindle-cells. In some areas there was a moderate development of fibrous tissue, in others, there was necrosis. The tissue was nowhere very vascular. In a few places there were strands of necrotic liver cells.

The lungs appeared to be normal except for the presence of a few small nodules on the surface which were about the size of miliary tubercules, but less well defined. The examination of microscopical sections showed that the lungs were full of metastatic deposits, similar in structure to the new growth in the liver. These occurred in the deep layer of the pleura, in the adventitia of the blood vessels and bronchioles, and in the septa. These deposits were nearly all of microscopic size; they were not encapsuled, but merged with the surrounding tissues, so that their limits were ill-defined. The capillaries of the lung were slightly congested, but the deposits of new growth excited no localized inflammatory reaction, they were surrounded by no small cell infiltration.

On the surface of the spleen there were a few small white nodules less than 1 cm. in diameter. These consisted of new growth similar to that found in the liver; the tissue in the centre of each had undergone degeneration. The nodules were well defined, but they were not encapsuled, they appeared to have pushed aside the tissue of the spleen.

On the outer surface of the right auricular appendix there was a small white nodule 2 mm. in diameter. The structure of this was the same as that of the other growths.

Within the stomach, on its posterior wall, there were three flat, umbilicated, white nodules, the largest of which measured 1 cm. in diameter. These tumours were of the same nature as those already described. They were sharply demarcated from the surrounding tissues, which they did not infiltrate, but had thrust aside in their growth. They were imbedded in the mucosa which overlapped their margins but was not continuous over their free surfaces, which projected into the cavity of the stomach. They were superficial to the *muscularis* which had atrophied beneath them.

The chief point which arises in connexion with this case is whether the primary growth had its origin in the liver or in the stomach. The new growth in the liver had entirely destroyed the tissues of that organ except a few strands of degenerate liver cells near the surface; the centre of the viscus was necrotic and semi-fluid. The growths in the stomach were small, they had undergone no degeneration, and they were not fibrotic. These are points in favour of the tumour in the liver being the parent growth, yet it is difficult to see how a primary growth in the liver could give rise to metastatic deposits in the mucosa of the stomach, though the reverse occurs frequently. The spindle-cells in some parts of the tumours were very large so that it was a matter of difficulty to decide whether they were fibres of unstriped muscle or only large spindle-cells. It is possible, therefore, that the primary growth may have been a malignant myoma of the stomach. On the other hand, the small size of the gastric tumours, the absence of degeneration or differentiation into fibrous tissue, and the absence of ulceration over them are all points in favour of the liver tumour having been the primary growth.

Other routine work.

Material forwarded by medical and veterinary officers has included specimens for examination for cholera, diphtheria, cerebro-spinal meningitis, piroplasmosis, &c.

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Chemistry.

Mr. Blair furnishes the following report:—

The total number of analyses performed during the six months was 589, which may be classified as follows:—

1.	Waters	62
2.	Milks	118
3.	Chandu and chandu dross	71
4.	Morphine	44
5.	Counterfeit coins and materials	171
6.	Articles examined for blood stains	10
7.	Articles examined for poison	47
8.	Liquors	45
9.	Miscellaneous	21
10.	Special Analyses.	

1. Waters.

The examination of the Taiping supply was continued, and, from the results of the analyses, there is a slight improvement. The presence of spirogyra has only occurred in one sample since 1st April, 1913; and the absence partially proves that the filter beds are working satisfactorily.

Six samples from the Gombak and Klang rivers, which flow through Kuala Lumpur, were examined and, from the results, the river at Kampong Attap bridge was found to show the greatest pollution. The remaining samples of water examined were sent from different places in the Federated Malay States, and the majority of these samples were satisfactory from a chemical standpoint.

2. Milks.

One hundred and eighteen samples of milk were examined, the majority consisting of fresh milk samples collected by the Sanitary Board Inspector. Eighteen were found to be adulterated with water. The majority of the samples consisted of buffaloes' milk.

3. Chandu and Chandu Dross.

The majority of these samples were examined with a view to discovering whether the chandu present was of Government manufacture or not.

Five samples were found to contain chandu other than that manufactured by Government; the other samples were derived wholly or in part from Government chandu.

The dross in all cases was derived from Government chandu.

4. Morphine.

Of the samples examined for morphine hydrochloride, seven samples contained no morphine hydrochloride or salt of morphine, the remaining thirty-seven gave positive results. The amount of morphine hydrochloride varied from 50 per cent. to 60 per cent., the other constituent being as a rule milk sugar. Cinchonine hydrochloride has been found in a few of these samples.

5. Counterfeit Coins and Materials.

Sixty-three coins were examined and all were found to be counterfeit, being composed of an alloy of copper, antimony, and tin, obtained from britannia metal spoons. The materials for making these counterfeit coins consisted of plaster of paris moulds, occasionally containing metal castings, and liquids containing acid for cleaning purposes.

6. Articles Examined for Blood Stains.

Three of these articles gave negative results for blood, the articles consisting chiefly of clothes.

7. Articles Examined for Poison.

Thirty-one of these consisted of stomach contents and viscera, fourteen gave positive results. The poisons found were opium (five), and arsenic (nine). Five cases of arsenical poisoning were received from Kuala Kubu, the victims had eaten "white ant powder," a granular mass resembling a Malay cake, for which it was mistaken. "White ant powder" consists mainly of arsenic and sulphur.

Three specimens of "ringut," the fruit of *epipremnum giganteum*, Scott, were submitted for examination.

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8. Liquors.

Complete analyses were made of twenty-nine spirits and partial analyses of sixteen samples of various liquors; some of these analyses are carried out for excise purposes.

Sixteen samples of toddy were examined and none of the samples could be said to be adulterated.

9. Miscellaneous.

These included the following:—Six Malay medicines, none of which were found to contain alkaloids. Four anti-opium samples, of which two contained a small proportion of morphine hydrochloride.

A sample of tea, supposed to have been adulterated, was examined, but no adulteration was found.

10. Special Analyses.

A large number of samples of milk have been collected both in the early morning between 3.30 a.m. to 5.30 a.m. and in the afternoon between 2 and 4 p.m., with a view to determining the average composition of the milk obtained from buffaloes and cows. This work will be continued as time permits.

H. Fraser,
Director, Institute for Medical Research, Federated Malay States.

Annexure.

The Bacillus Lepræ: Has it been Cultivated?

By Henry Fraser, M.D., Aberdeen, Director, Institute for Medical Research, Kuala Lumpur, Federated Malay States, and

William Fletcher, M.D., Cantab., Pathologist, Institute for Medical Research, Kuala Lumpur.

During recent years various investigators have recorded the successful cultivation of the bacillus lepræ on artificial media. The means by which it is stated that the saprophytic existence can be induced vary considerably. Some assert that the organism will grow on ordinary media, others that media resembling in composition the tissues and fluids of the body are indispensable, while others claim that the cleavage products of proteins are essential. There is a lack of agreement in regard to the characters which the bacillus is said to exhibit in culture. Some writers state that the organism is consistently acid-fast, others are of opinion that it is not. Some claim that the organism becomes converted into a streptothrix, others contend that it becomes a non-acid-fast bacillus. In order to reconcile the inconsistencies and discrepancies, it has been asserted that the leprosy bacillus is a "pleomorphic organism." The introduction of this term is unfortunate, since it has enabled various workers to assert that organisms which have no genetic relationship with the bacillus lepræ have evolved from that organism.

There are difficulties in inducing strongly parasitic organisms to adapt themselves to saprophytic conditions. When investigators overcome these difficulties it is customary for them to describe their methods in detail, so that their work can be repeated by anyone possessed of the necessary facilities and skill. The claims made by the original investigators are tenable provided that their accuracy is thus independently confirmed and the results obtained are uniformly consistent; this is not the case with the work which has recently been recorded in connexion with the cultivation of the leprosy bacillus. During the past eighteen months work has been carried on here with a view to the cultivation of the bacillus lepræ. The experiments represent a uniform series of failures to obtain a growth of this bacillus, and it therefore appears desirable that they should be recorded.

Method of obtaining material.

The leper asylum is situated within half a mile of the Institute, and contains more than two hundred and fifty patients. From among these, non-ulcerating cases were invariably selected; from dirty, ulcerating cases it is possible to cultivate all manner of organisms. The patients came willingly to the Institute for observation, so that the work was done under much more favourable conditions than would have been the case had necessity compelled us to transport our materials to the leper

asylum. In the first experiments bacilli were obtained by disinfecting the skin over a nodule, which was then punctured. On applying pressure to the punctured nodule blood exuded; this was wiped off, and the pressure continued until a serous fluid was obtained. This fluid, rich in leprosy bacilli, was inoculated on the media by means of a platinum loop. The procedure was not successful—all the tubes were contaminated. Aspiration of fluid from the nodules was next tried; only small amounts of juice were obtained, and the inoculated tubes were all contaminated. Normal saline solution was injected into the nodules, which were then massaged, and afterwards an attempt was made to aspirate fluid from the nodules. Only small quantities of fluid were obtained, and the inoculated tubes were contaminated.

The following procedure was eventually adopted with excellent results :—

1. The skin over and around the nodule was painted with tincture of iodine prepared with 70 per cent. alcohol.
2. Sterile solution of cocaine was injected into the tissues surrounding the nodule.
3. A sterile suture of silkworm gut was passed through the peripheral part of the nodule.
4. A second application of tincture of iodine was made.
5. When the skin had dried, a horseshoe-shaped incision was made around the nodule and a flap of skin reflected from the subjacent tissues.
6. The skin flap was held back by means of the silkworm gut suture and from the subjacent tissues small pieces were excised; these were inoculated directly on to the media.
7. When a sufficient amount of tissue had been excised the skin flap was returned and sutured. Healing by first intention can invariably be obtained.

In a number of experiments conducted recently nodules on the ear have been selected. In these cases a simple incision has been made and the wound made to gape by means of sutures inserted on each side of the incision. From the depth of the wound pieces of tissue were excised. In every case a portion was excised for microscopical examination. Abundance of leprosy bacilli was invariably found, so that no objection can be raised on the ground that an insufficient number was inoculated.

Nutrient agar.

In experiments with blood, with serum, and with placental extracts, these fluids were mixed with equal parts of nutrient agar of the following composition :—

Powdered agar	40 grms.
Peptone	10 grms.
Salt	5 grms.
Glycerine	60 c.c.
Meat extract to	1000 c.c.

The preparation was carried out in accordance with the methods described in Eyre's "Bacteriological Technique." The medium was titrated with N/10 NaOH. When a medium of reaction + 10 was required the calculated amount of N. NaOH. was added. When an alkaline or −10 medium was required, the calculated amount of $N.Na_2CO_3$ was added; only by this procedure can an alkaline nutrient agar be prepared (1).

Incubation.

With the exception of some experiments carried out in accordance with the methods employed by Duval (2), incubation was invariably effected in Hearson's incubators at a temperature of 37°C.

It is stated (2) that the bacillus lepræ requires an abundant supply of oxygen and therefore cannot be grown in rubber-capped tubes; certainly no culture of the organism has been obtained by us when this procedure was employed. If the tubes are incubated in the ordinary way, evaporation proceeds and the medium becomes unsuitable. To obviate this, incubation in moist chambers has been recommended, but, in our experience, this procedure is unsatisfactory; moulds rapidly form on the plugs and, unless great precautions are taken, the media become contaminated. Satisfactory results are obtained by incubation in the ordinary way, and from time to time adding, by means of sterile Pasteur pipettes, sterile distilled water to replace the water of condensation lost by evaporation.

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Experiments with blood-media.

In a previous series of experiments (3) carried out in connexion with the cultivation of the gonococcus, the Koch-Week's bacillus and the diplobacillus of Morax-Axenfeld, it was found that these organisms could be cultivated readily on a +10 nutrient agar which had been mixed with sterile unheated ovarian or ascitic fluids. It was further found that ovarian fluid was more suitable than ascitic fluid. The ovarian fluid was apparently superior because of its higher albumen-content and the presence of blood-derivatives. Following up the train of thought suggested by these experiments citrated ox-blood was employed in place of ovarian fluid and found to yield equally luxuriant cultures of these organisms.

The excellent results obtained by the use of these media suggested the probability of their usefulness in the cultivation of the bacillus lepræ.

Sterile ox-blood is not readily obtainable in this country, because of the method by which cattle are slaughtered, and ovarian tumours are rarely met with in the hospitals.

We therefore decided to employ citrated human blood. Test-tubes each containing 0.0125 gramme of sodium citrate dissolved in 0.5 c.c. of distilled water were sterilized in the autoclave for twenty minutes at 120°C. Under aseptic precautions blood was removed from the median-cephalic vein, and 5 c.c. added to each test-tube containing sodium citrate. Tubes each containing 5 c.c. of the + 10 nutrient agar were melted and cooled to 45°C. To each tube 5 c.c. of citrated blood were added, the contents mixed, sloped and cooled rapidly by means of ice and salt.

The tubes were incubated for two days in order to test their sterility.

In the first instance, the suitability of this medium for the growth of the tubercle bacillus was tested. Sputum from a case of pulmonary tuberculosis was inoculated into the groin of a guinea-pig. Three weeks later the animal was killed and, under aseptic precautions, the spleen was removed; it was not apparently tubercular, and a cursory examination of a stained smear did not reveal the presence of tubercle bacilli.

Pieces of the spleen were inoculated into six blood-agar tubes, which were then capped and incubated at 37°C. Three of the tubes were contaminated, but, in the other three, growth of tubercle bacilli slowly occurred, and by the fourth week the growth was distinct. Subcultures were made on the blood-agar, and profuse growths obtained. Only a relatively small number of bacilli were inoculated into the original tubes. In our experiments with leprosy bacilli it was designed to inoculate large numbers of organisms because of the possibility, which has been suggested, that many of the bacilli found in the tissues are dead.

Clegg (4) in his experiments claims to have cultivated the organism in symbiosis with amœbæ. He employed a 1 per cent. alkaline agar. Duval (2) claims to have confirmed the accuracy of Clegg's work. An alkaline blood-medium was therefore prepared.

Tubes containing 5 c.c. of the −10 nutrient agar were melted and cooled to 45°C. To each tube was then added 5 c.c. of citrated blood; after mixing, the tube was sloped and the contents cooled rapidly by means of ice and salt. The sterility of the tubes was tested by incubation for two days.

Tubes containing + 10 blood-agar with 0.5 per cent. glucose and tubes containing −10 blood-agar with 0.5 per cent. glucose were prepared for anærobic cultures.

These tubes were inoculated with material obtained from seventeen non-ulcerating nodular cases of leprosy. From any one nodule the minimum number of tubes inoculated was four and the maximum number thirteen. In all 82 inoculations were made on + 10 blood-agar and 63 inoculations on −10 blood-agar. Every tube received a piece of tissue, on an average, equal in size to that of a rice-grain and swarming with leprosy bacilli.

The tubes were incubated anærobically and ærobically.

The maximum period of anærobic cultivation was two months and there was no apparent prolification of the bacilli.

The maximum period of ærobic cultivation was nine months. From no tube incubated ærobically has a culture of the bacillus lepræ been obtained; the organisms persist but, in our opinion. do not proliferate. They retain their form and their acid-fastness.

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Experiments with blood serum.

Under aseptic precautions, blood was collected from normal individuals and lepers. The blood, in quantities of 10 c.c., was placed in sterile test-tubes and, after coagulation had taken place, the serum was transferred to sterile test-tubes and inactivated by heating at 56°C. for thirty minutes. Twelve tubes containing leper-serum and twenty containing normal serum were prepared in this way. Two nodular cases of leprosy furnished the material with which the tubes were inoculated.

Six inoculated tubes of leper-serum and nine inoculated tubes of normal serum were incubated anærobically. Once a week, or thereabouts, the cultures were removed and examined. Sterile distilled water was then added to the tubes requiring it, in order to bring the fluid up to its original volume, and anærobiosis was restored. One tube was found to be contaminated with a stout non-acid-fast bacillus on the occasion of the first examination, the remaining tubes showed neither macroscopically nor microscopically that proliferation of the bacilli had occurred.

Six inoculated tubes of leper-serum and eleven inoculated tubes of normal serum were incubated ærobically. The original volume of fluid contained in each tube was restored from time to time by the addition of sterile distilled water. In none of the tubes has proliferation of the leprosy bacilli been observed. These experiments were discontinued after six months.

Experiments with serum-agar.

Serum was obtained in the manner described under experiments with blood-serum.

Alkaline nutrient agar, with and without one per cent. glucose, and +10 nutrient agar, with and without glucose, contained in tubes in quantities of 5 c.c., were melted and cooled to 60°C.; each tube then received 5 c.c. of serum. The mixtures were allowed to set as slopes. After incubation for forty-eight hours to test their sterility, each tube received a portion of a leproma.

The tubes containing glucose-media were incubated anærobically and the others ærobically.

Eight tubes of —10 serum-agar were inoculated from four cases, and eight tubes of —10 serum-glucose-agar were inoculated from four cases.

Eight tubes of +10 serum-agar were inoculated from four cases, and eight tubes of +10 serum-glucose-agar were inoculated from four cases.

On incubation several of the tubes of +10 serum-agar showed minute dew-drops either adjacent to, or at some distance from, the nodule. On examination the dew-drops were found to contain leprosy bacilli. The question arose, were these dew-drops colonies or merely droplets of moisture exuded from nodules swarming with lepra bacilli? Further observations have confirmed the accuracy of the latter view.

Experiments with Rost's medium.

For his initial cultures (5) this investigator employed a medium of the following composition:—

Distilled volatile alkaloid of rotten fish ...	250 c.c.
Weak Lemco-broth without salt or peptone	250 c.c.
Milk	50 c.c.

Burmese preserved fish was not available. Williams (5) has shown that distilled water may be substituted for the fish-distillate. It was not therefore considered necessary to obtain this kind of fish and to dismantle an autoclave for the purpose of preparing the distillate. As, in addition, it is directed that the medium should be sterilized in the autoclave, it is difficult to see that much, if any, of this volatile alkaloid can remain in the medium.

Rost's medium was prepared in accordance with Williams's modification.

Rost prepared his cultures by incubation at 30°C., but Williams has shown that incubation at 37°C. is equally effective; the latter procedure was therefore adopted. Rost states that leprosy bacilli proliferate when incubated at 30°C. along with blister-fluid contained in pipettes. Our experiments with serum did not confirm this observation.

The method employed by him, of squeezing out the fluid from a nodule exposed under aseptic precautions, appeared to us likely to increase the risks of contamination, and was therefore not adopted.

Six tubes were inoculated with leprous tissue obtained from one patient, and six tubes were inoculated with tissue from another patient. None of them were contaminated, and films prepared from time to time did not show that the bacilli had proliferated.

After incubation for two and a half months most of the media had evaporated and the pieces of tissue were transferred to fresh tubes.

A month later films were prepared from all the tubes, but in no single instance was there evidence of proliferation. The organisms were acid-fast and their appearance corresponded in every way with the acid-fast bacilli seen in films prepared from a fresh leprous nodule. Bizarre forms were never seen.

Experiments with Williams's medium.

This investigator claims (5) to have obtained initial cultures of the leprosy bacillus on ordinary nutrient broth when incubated at room-temperature and on potato-broth when incubated at 37°C.

He gives no special directions for the preparation of potato-broth; it was, therefore, prepared in the ordinary way. Pieces of tissue were obtained in the manner already described, and twelve tubes were inoculated from two cases of leprosy; six tubes from each case.

The tissue from both cases swarmed with acid-fast bacilli. The tubes were incubated, as recommended by Williams, at 37°C. The cultures were examined from time to time, but proliferation of the bacilli was never observed.

After incubating for two and a half months, as the media had almost entirely evaporated, the pieces of tissue were transferred to fresh tubes. A month later this experiment was ended. Films were prepared from the culture fluid in each of the twenty-four tubes. The films were stained and examined; only occasionally were bacilli met with, and these were invariably acid-fast.

Films were prepared from the inoculated pieces of tissue. The cells had entirely disappeared. Bacilli, invariably acid-fast, were present in great abundance. They invariably showed the ordinary form of the leprosy bacillus, bizarre forms were never seen, and there was nothing to indicate that the bacilli were more numerous than in the tissue originally inoculated; in short, there was no evidence of proliferation.

Experiments with Duval's media.

Clegg (4) claims to have grown the bacillus in symbiosis with amœbæ. Duval (2) states that he has confirmed the accuracy of Clegg's work.

He (6) found that symbiosis with amœbæ was not essential and that, in symbiosis with organisms capable of decomposing proteins, a culture of the bacillus lepræ could be obtained on ordinary media. He (2) also found that the bacillus could be cultivated on media containing amino-acids; tryptophane and cystein are said to be the most important of these substances.

Casein was not available here and an attempt was made to prepare tryptophane from condensed milk, but the quantities obtained were insufficient for experimental purposes. As, in addition, he has stated (6) that trypsinized egg-medium will yield equally good results the work of preparing amino-acids was abandoned.

We therefore prepared tubes of Dorset's egg-medium and inoculated them with pieces of leprous tissue. The surface of the medium was then covered with a sterile solution of trypsin. Duval at first laid stress on the importance of incubation at 32°C., but later he appears to cultivate the organism quite readily at 37°C. Twenty-two tubes in all were inoculated; half of them were incubated at 32°C. and the other half at 37°C.

After some days the media in the tubes had been digested into a slushy mass. No evidence was obtained from any of the tubes that proliferation of the bacilli had occurred.

Again following Duval, egg-albumen in Petri-dishes was inspissated for three hours at 70°C. and each plate then received a piece of leprous tissue. The surface of the medium was covered with a sterile solution of trypsin and the plates incubated at 37°C. Most of them became contaminated, but in the few which remained uncontaminated there was no evidence of proliferation.

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Still later, Duval and Wellman (7) (8), following Kedrowsky, recommended the use of placental agar. The method of preparation differs in some respects from that employed by Bayon (9).

Thirty tubes of placental agar, prepared by their method, were inoculated direct with leprous nodules excised from two lepers. The tubes were incubated at 37°C. and after a few days two of them were observed to be contaminated. The remaining twenty-eight tubes have now been under observation for more than six months. A moist condition of the media has been maintained by the procedure described in connexion with blood-media. In none of these tubes is growth apparent macroscopically, and films prepared from the inoculated nodules show, in our opinion, persistence but not proliferation of the acid-fast bacilli.

Experiments with Bayon's medium.

This investigator has employed various media (9), among others placental agar, prepared according to the manner described by Kedrowsky.

Bayon, in his published works, does not state the method of preparing the placental agar, but in reply to a communication addressed to him we were furnished with the necessary particulars, which are as follows :—"A fresh placenta is chopped up fine, mixed with its weight of sterile distilled water and then frozen hard for twelve hours. It is then thawed rapidly at a little over room temperature, say 20°C., and the juice squeezed out with a meat press. The resulting liquid is rapidly passed through a paper filter and then put through a tandem arrangement of Berkfeld and Doulton filters. It ought now to be absolutely sterile and has to be mixed with equal quantities of 4 per cent. glycerine-agar under aseptic precautions. The tubes cannot be heated, those that are found to be contaminated have to be thrown away".

Attention must be directed to the question of contaminated tubes. When the process described is accurately followed there should be, as was the case in our experiments, no contaminated tubes.

Twenty tubes of this medium were inoculated from one case of leprosy and fifteen from another. The tubes have now been incubated for over six months, a moist condition being maintained by the method already described. Not one of them shows contamination and not one of them shows a culture of the leprosy bacillus.

Experiments with serum-water.

Blood was drawn from the jugular vein of a sheep and the serum separated. The serum was mixed with distilled water in the proportion of one of the former to three of the latter. The serum-water was filled into tubes and, in the case of those destined for anærobic cultures, a thick layer of oil (*paraffinum liquidum B.P.*) was poured on the surface. The media were sterilized by heating for half an hour at 100°C. on three successive days.

Eight tubes, for ærobic culture, were inoculated with pieces of leper-tissue obtained from four cases, and thirteen tubes for anærobic culture were inoculated from five cases. The inoculated tubes have now been under observation for three months and no culture has been obtained.

Experiments with salt-solution.

Tubes containing salt-solution were prepared for ærobic culture and for anærobic culture with oil as described in the previous section.

Five tubes for ærobic culture were inoculated from three cases and eight tubes for anærobic culture were inoculated from four cases. The inoculated tubes have now been under observation for three months and no culture has been obtained.

Experiments with Ringer's fluid.

Tubes containing Ringer's fluid were prepared for ærobic culture and for anærobic culture with oil as described under serum-water.

Five tubes for ærobic culture were inoculated from three cases and eight tubes for anærobic culture were inoculated from four cases.

The inoculated tubes have now been under observation for three months and no culture has been obtained.

Experiments with milk-agar.

Alkaline-agar was mixed with fresh milk in equal proportions. The mixture was transferred to tubes and sterilized.

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Nineteen slopes of this medium were inoculated from three cases. The inoculated tubes have now been under observation for three months and no culture has been obtained.

Milk does not form a homogeneous preparation with + 10 agar and the mixture did not appear suitable.

Contaminating micro-organisms.

These may, for convenience, be grouped into:

1. Contaminating micro-organisms introduced with, or at the time of introducing, the nodule.
2. Contaminating micro-organisms introduced subsequently either by growing through the cotton-wool-plug or during the manipulations entailed by the moistening of the media.

In the early stages of our investigations and before sufficient technical skill had been acquired it not infrequently happened that contaminated nodules were inoculated.

On incubation the presence of these organisms was demonstrated by the occurrence of a macroscopic growth, visible as a rule within a few days. Colonies of staphylococci call for no special comment. In some instances the nodule showed, on blood-media, a brownish growth; at first limited, but gradually spreading over the surface of the medium either as a continuous growth or as isolated colonies. On examination these growths were found, in certain instances, to consist of a slender non-motile rod mixed with large coccoid spores. This organism is of importance, because it would appear that observers have mistaken such spores, when stained by the Ziehl-Neelsen method, for acid-fast organisms. This bacillus grows freely on ordinary agar, forming a yellowish crinkled growth.

In this connexion reference must be made to Bayon's "acid-resisting" and acid-fast organisms (9). Anyone who has worked with acid-fast organisms must be aware of the power with which these germs retain the carbol-fuchsin. It is wrong to describe germs as "acid-resisting" because they retain the carbol-fuchsin after momentary immersion in weak acid. It is an attempt to explain his transition stages from a non-acid-fast streptothrix to an acid-fast bacillus; and is, in our experience, unsound and misleading.

In common with other workers we have isolated diphtheroid organisms, but these are ubiquitous and demand no special consideration.

Granting that either of these contaminating bacilli has a genetic relationship with the bacillus of leprosy, how are the results observed in the following experiment to be explained? Ten tubes of blood-agar were inoculated with pieces of leprous tissue from one nodule swarming with acid-fast organisms. On incubation there developed in one of the tubes a culture of a non-acid-fast organism. In the remaining nine tubes no cultures were obtained. It is impossible to believe that in this nodule there was only one part of it in which a living acid-fast germ was present and that that germ should on proliferation give rise to a non-acid-fast organism growing freely on ordinary media.

In other instances the growth was found to consist of a streptothrix which grows readily but slowly on + 10 nutrient-agar in the form of orange-red colonies and on −10 nutrient agar in the form of greyish-brown striated colonies.

Smears prepared from nodules which have become contaminated with either a streptothrix or a bacillus invariably show masses of leprosy bacilli, because these organisms are so abundant in the tissues employed. If a tube of nutrient agar be inoculated with an emulsion prepared from such a nodule a growth will readily be obtained and smears prepared from this may show the presence of some acid-fast bacilli among the contaminating organisms because the former have been so numerous in the inoculated material. In the second subculture on nutrient agar acid-fast bacilli may or may not be found; most probably not.

The fact that these contaminating organisms grow in the first subculture on + 10 nutrient agar is strong evidence against them having originated from leprosy bacilli, and from the numerous examinations made we have no hesitation in stating that they have no connexion with the leprosy bacillus. Several investigators have described in detail the gradual transformation of the acid-fast bacilli

into non-acid-fast organisms. They must have been led into error by the mechanical transference of non-proliferating acid-fast organisms along with freely-growing non-acid-fast saprophytes. We know of no organism with strongly parasitic characters and whose saprophytic existence can only be stimulated by the use of special media which will grow freely in the first subculture on ordinary media.

The organisms belonging to the second group are similar to those mentioned in the first group. Very infrequently moulds have been met with.

As a type of the contaminations met with, the following instance may be quoted. On the 9th September, 1912, eight tubes of −10 blood-agar were inoculated with pieces of leproma rich in bacilli. On the 16th September a growth appeared on and around the piece of tissue in one of the tubes. Smears showed the presence of a spore-bearing bacillus and groups of acid-fast-bacilli. The contaminator grew freely on + 10 nutrient agar.

On the 6th January, 1913, another of the tubes was observed to be contaminated. A brownish growth spread upwards from the water of condensation, but there was an interval of about three-quarters of an inch between the upper margin of the growth and the piece of leprous tissue. That interval was free from the growth, which examination proved to consist of staphylococci and a streptothrix. In smears prepared from the nodule there was the usual abundance of acid-fast bacilli, but no non-acid-fast bacilli and no streptothrix. Clearly, therefore, the streptothrix could not have originated from the lepra-bacillus.

Subcultures on + 10 nutrient agar were prepared and the streptothrix isolated. An entire culture in + 10 bouillon, seven days old, was injected into the peritoneal cavity of a guinea-pig. The animal did not become in any way affected. Forty days later it was killed, and all the organs appeared healthy.

An entire culture in + 10 bouillon, fourteen days old, was injected into the peritoneal cavity of a second guinea-pig. This animal died ten days later.

The animal was well nourished and presented no external lesions. On opening the abdomen the great omentum was found to be rolled up and matted together, forming a sausage-shaped mass. This mass was full of caseous and purulent tubercles, mostly about the size of a pin's head. There was a small tubercle on the surface of the bladder, two on the right seminal vesicle, and a group of them on the under surface of the diaphragm. The superior mesenteric glands were enlarged and contained caseous and suppurating tubercles. The spleen was enlarged and studded with nodules. The kidneys and suprarenal capsules were congested and swollen, but contained no nodules.

On opening the thorax the upper part of the right lung was found to be solid and caseous. In the centre of the inferior lobe there was an aggregation of tubercles surrounded by congested lung-tissue.

Smears from the omentum showed the presence of the streptothrix mixed with cell debris and cocci. The streptothrix stained by Gram's method, but it stained poorly and had a granular, degenerate appearance.

The tubercles in every instance showed the same histological characters. The microscopic appearance of those in the lung was similar to that of the nodules which were found in the mesenteric glands and omentum. They consisted of sharply defined masses of irregular necrotic nuclei, imbedded in amorphous debris, which stained pink with eosin. They were not surrounded by epithelioid cells, fibrous tissue or small cell infiltration. Except in the lung, they were surrounded by healthy tissue and did not appear to have given rise to any inflammatory reaction. No blood vessels penetrated the substance of the tubercles, and there were no pathological changes in the capillaries of adjacent tissues.

The tubercles within the mesenteric glands were situated in the neighbourhood of the divisions of the afferent lymphatic vessels which supply the cortex.

In the liver there were no macroscopic lesions, but microscopically numbers of tubercles were found in the portal spaces and in the portal zones of the lobules. It was possible to recognize the remains of degenerate liver cells lying amidst the necrotic material which formed these minute nodules, but the trabeculæ surrounding the tubercles appeared normal.

Within the lung, the nodules did not lie in healthy tissue, but were surrounded by a zone of consolidation in which the alveoli and bronchioles were blocked by masses of catarrhal cells. External to this the capillaries were intensely congested and the alveoli were filled with a fluid exudate.

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The presence of the streptothrix was not demonstrated in the lung, but it was found in sections of the lymphatic glands, mesentery, and liver where it was similar in character to that seen in the smears made from the fresh organs. No acid-fast organisms were found in any of the sections or smears.

Summary.

Material for purposes of cultivation on various media has now been obtained from thirty-two non-ulcerating nodular cases of leprosy and three hundred and seventy-three inoculations made on the various culture-media.

It is curious, in view of the findings of other investigators, that we have consistently failed to obtain a culture of the bacillus lepræ. There can be no doubt but that material swarming with bacilli has been employed on each occasion. This was clearly demonstrated by the microscopical examinations which were made in every case.

From the examinations made of nodules, which have been incubated on culture-media for periods ranging from a few days to nine months, no evidence has been obtained that the bacilli had increased or lessened in number.

Those investigators who have recorded an increase in the number of organisms as a result of miscroscopical examination must surely have failed to observe the bacterial richness of the material employed for inoculation.

Anyone who has examined smears prepared from freshly excised leper-tissues must be struck with the enormous masses of acid-fast bacilli present, and we are unable to comprehend how it is possible to state in a case where no macroscopic growth is apparent that an increase recognizable only by the microscope (2) (6), has occurred.

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Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

No. 2.

HONG KONG.

REPORT ON WORK (OTHER THAN ROUTINE WORK) DONE IN THE BACTERIOLOGICAL INSTITUTE DURING THE SIX MONTHS—1st JULY TO 31st DECEMBER, 1913.

(Received 6th March, 1914.)

The investigation of the mosquitoes in Hong-Kong mentioned in my last report of the 20th August, 1913,* has been continued, and another year's work will be required before it is completed.

The method of carrying out this work has already been described.

Up to date, 4,171 different samples of larvæ have been collected, and from these samples 12,763 mosquitoes have been bred and pinned.

After being arranged and classified as far as practicable, 5,736 of these specimens have been forwarded to the Director of the Imperial Bureau of Entomology—British Museum (Natural History)—and the remaining 7,027 specimens are being got ready as quickly as possible for forwarding.

As these mosquitoes will be finally classified in the British Museum, it is unnecessary for me to give my provisional classification at this stage.

As regards the collection of larvæ, the arrangements made for larvæ other than stegomyia appear to me to be satisfactory. It is only a matter of time till a representative collection will be got together.

The stegomyia collection, on the other hand, is quite unsatisfactory, and some other arrangements will have to be made if that part of the investigation is to be thoroughly carried out.

At present two separate samples of *Stegomyia fasciata* have been found widely separated from each other in the city of Victoria. All the other samples of stegomyia are apparently *Stegomyia scutellaris*, but confirmation on this point will be supplied by the Director of the Imperial Bureau of Entomology in due course.

If *Stegomyia fasciata* had been a common mosquito in Hong Kong—or had not been found at all—the position would be a simple one, but as it is only the most thorough search will now put matters on a satisfactory basis.

So far no collections have been made from junks or sampans in the harbour. Judging from the results obtained in Bombay and elsewhere this search should certainly be made. Search should, I consider, also be made of ships coming daily into the harbour from ports infected with *Stegomyia fasciata*, *e.g.*, Singapore, Java, etc., to see if they ever bring specimens here.

HAROLD MACFARLANE,
Government Bacteriologist.

Bacteriological Institute,
Hong Kong, 28th January, 1914.

No. 3.

HONG KONG.

The GOVERNOR to the SECRETARY OF STATE.

(Received 26th October, 1914.)

Sir, Government House, Hong Kong, 7th September, 1914.

I have the honour to transmit the enclosed copy of a report by the Government bacteriologist on the work, other than that of a routine nature, done in the Bacteriological Institute during the first half year of the year 1914.

2. You will observe that the presence in the Colony of *Stegomyia fasciata* and *Stegomyia scutellaris*, which was referred to in paragraph 5 of your despatch of the 22nd August, 1913,† has now been definitely established. Further investigations in this direction are being prosecuted.

I have, &c.,
F. H. MAY,
Governor.

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* Page 158 of [Cd. 7261], March, 1914. † Not printed.

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REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

Enclosure in No. 3.

Report on Work other than Routine Work done in the Bacteriological Institute, Hong Kong, for the First Half-Year, 1914.

The investigation of the mosquitoes of Hong Kong, mentioned in my previous report,† has been continued, and arrangements have been made to carry on this work till the end of this year.

It is therefore undesirable at this stage to attempt anything more than a brief summary of the work so far done.

The total number of samples of larvæ collected and brought to this institute for breeding out now amounts to 11,671.

From these samples of larvæ, 28,000 adult mosquitoes have been bred out and pinned.

Twenty-two thousand six hundred and seventy-one of these specimens have been forwarded to the Director, Imperial Bureau of Entomology (British Museum), for determination, and 12,731 out of the 22,671 specimens have already been named by the Bureau.

These 12,731 specimens have been classified by the Bureau as follows :—

Anopheles indiensis, Theo.
Anopheles jeyporiensis, Theo.
Anopheles karwari, James.
Anopheles maculatus, Theo.
Anopheles maculatus, Theo. var.
Anopheles minimus, Theo.
Anopheles minimus, Theo. var.
Anopheles rossi, Theo. var. *indefinatus*, Ludl.
Anopheles sinensis, Theo.
Anopheles tesselatus, Theo.
Armigeres obturbans, Walk.
Culex bitæniorhynchus, Giles.
Culex bitæniorchus, var, *domesticus*, Leic.
Culex concolor, R.D.
Culex fatigans, Wied.
Culex fuscocephalus, Theo.
Culex mimeticus, Noe.
Culex sinensis, Theo.
Culex sitieus, Wied.
Culex tritæniorhynchus, Giles.
Culex virgapites, Edw., sp. nov.
Culex vishnui, Theo.
Culiciomyia pallidothorax, Theo.
Ficalbia minima, Theo.
Lophoceratomyia minutissima, Theo.
Lophoceratomyia aubithoracis, Leic.
Mansonioides uniformis, Theo.
Micraëdes malayi, Leic.
Ochlerotatus greeni, Theo.
Ochlerotatus macfarlanei, Edw. sp. nov.
Uranotænia macfarlanei, Edw. sp. nov.
Stegomyia scutellaris, Walk.
Stegomyia fasciata, F.
Stegomyia W. alba, Theo.

(Asterisks before Anopheles indiensis, jeyporiensis, karwari, rossi, tesselatus; Culex bitæniorhynchus, bitæniorchus var. domesticus, fuscocephalus, mimeticus, sinensis, sitieus, virgapites, vishnui; Culiciomyia pallidothorax; Ficalbia minima; both Lophoceratomyia; Mansonioides uniformis; Micraëdes malayi; both Ochlerotatus; Uranotænia macfarlanei; Stegomyia fasciata; Stegomyia W. alba.)

All species marked * are new to Hong Kong.

Stegomyia fasciata is definitely present in the Colony, especially on the Kowloon side of the harbour from Yaumati to Shamshuipo, but apparently never in large numbers like *Stegomyia scutellaris*. However, as the search for *Stegomyia fasciata* still continues, it would be premature to make any definite statements at present.

† No. 2.

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Tabanidæ.—A collection of the Tabanidæ of Hong Kong, started originally by Mr. Adam Gibson, M.R.C.V.S., Colonial Veterinary Surgeon, and then carried on in partnership with me, has been undertaken.

One thousand five hundred and eight specimens have been forwarded to the Director of the Imperial Bureau, and a preliminary list dealing with 395 of these specimens has been received from him, and is as follows:—

Chrysops dispar, F.—168 ♀
C. striata, Wulp.—39 ♂
Tabanus crassus, Walk.—11 ♀
T. ditæniatus, Macq.—6 ♀
T. hilaris, Walk.—2 ♂ 7 ♀
T. hybridus, Wied.—2 ♀
T. indianus, Ric.—33 ♀
T. jucundus, Walk.—1 ♂ 10 ♀
T. negativus, Ric.—1 ♀
T. sanguineus, Walk.—90 ♀
Tabanus sp. nov., near *birmanicus*, Big.—3 ♀
Tabanus sp. nov., near *inobservatus*, Ric.—22 ♀

HAROLD MACFARLANE,
Government Bacteriologist.

5th August, 1914.

No. 4.

CEYLON.

THE GOVERNOR to THE SECRETARY OF STATE.

(Received 14th March, 1914.)

SIR, The Queen's Cottage, Nuwara Eliya, Ceylon, 21st February, 1914.

WITH reference to Mr. Stubbs's despatch of 13th August, 1913,* I have the honour to forward herewith, for transmission to the Advisory Committee of the Tropical Research Fund, a report (with photographs)† by Dr. Aldo Castellani on research work carried out at the Clinic for Tropical Diseases and Bacteriological Institute, during the period from 1st July, 1913, to 31st January, 1914.

I have, &c.,
ROBERT CHALMERS,
Governor, &c.

Enclosure in No. 4.

REPORT OF INVESTIGATION WORK CARRIED OUT AT THE CLINIC FOR TROPICAL DISEASES AND BACTERIOLOGICAL INSTITUTE DURING THE PERIOD EXTENDING FROM 1ST JULY, 1913, TO 31ST JANUARY, 1914, BY ALDO CASTELLANI, M.D., DIRECTOR CLINIC FOR TROPICAL DISEASES AND BACTERIOLOGICAL INSTITUTE.

Researches have been carried out on the following subjects:—

(1) Cases of fever due to *Bacterium columbense* (Cast. 1905).
(2) *Vibrio kegallensis* (Cast. 1913).
(3) Further researches on the mixed typhoid + paratyphoid A + paratyphoid B vaccine.
(4) Further case of entoplasmosis.
(5) A probably new type of ulcerative dermatitis.
(6) Skin disease with gummata, due to a fungus.
(7) A peculiar yellow pigmentation of the skin.

I wish to express my indebtedness to Mr. E. Burgess, Assistant Bacteriologist, for the very valuable assistance rendered during these investigations. My thanks are also due to Dr. Fernando, my house physician.

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* Page 131 of [Cd. 7261]. † Not reproduced.

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Note on Cases of Fever Due to Bacterium Columbense (Cast. 1905).

In 1905 I described a case of fever due to a germ which I called *B. columbense.* Later, having been impressed by the sugar reactions of the germ being not very characteristic, I no longer considered it a separate species, and in my subsequent publications I identified it—wrongly—with *B. paratyphosus B.* Recently, I have had opportunity of isolating the same germ in two cases, and of studying it more completely, and I have been forced to the conclusion I came to years ago, *viz.*, that the germ is a separate species. The experiments have been carried out on three strains which I have in my hands—one, the original strain isolated in 1905, and two strains isolated recently. The three strains are absolutely identical, and therefore I will refer to them simply as *B. columbense*, the name I gave to the organism in 1905. The term may not be a very appropriate one, but, according to the laws of nomenclature, cannot be changed.

Remarks on the cases.—The cases clinically were very similar to typhoid of medium severity; the fever lasted from three to five weeks, ending by lysis; in one case there were several relapses: pulse varying from 90 to 120, spleen enlarged in two cases, impalpable in the third; constipation present in two cases, slight diarrhœa in one. In one case severe bacilluria occurred, which lasted several months after the fever had ceased.

Microscopical and bacteriological examination of the foregoing cases. A slight degree of oligocætemia present in all; nothing important to be noted with regard to the leucocytic formula; the number of large mononuclear cells was not increased, varying from 3 to 10 per cent. Laveran's parasites always absent, Widal test constantly negative. Agglutination test for paratyphoid A and B, *Micrococcus melitensis*, and *B.asiaticus* repeated in each case several times, always negative. The germ, of which I will again give a description presently, was grown from stools (plated in the usual way) of all three cases, from the urine of one, and the blood of one. From the blood it was isolated by using the dilution method, introduced by me some years ago for typhoid. Five ccs. of blood were taken from an arm vein by means of a sterile syringe, using the ordinary aseptic precautions. The blood was inoculated at once into several large flasks containing each 300 ccs. of broth. The flasks were incubated at 35°C. After two days two out of the six flasks showed growth of the germ.

Characters of Bacterium columbense (*Cast.* 1905). Rods 2 to 5 micron in length closely resembling the typhoid and paratyphoid bacilli, motile. It is easily stained by the ordinary aniline dyes, but not by Gram.

Cultural Characters :—

Broth.—Abundant growth with diffuse turbidity; after twenty-four to forty-eight hours a delicate pellicle is generally present.

Agar.—The growth may be typhoid-like, but generally the germ grows more luxuriantly than is the case with typhoid.

Gelatine.—Typhoid-like or at times *B.coli*-like, medium not liquefied.

Serum.—Nothing characteristic, the medium is not liquefied.

Litmus Milk.—It may be said that in general it becomes acid at first and alkaline later, and that bleaching of the medium is of very frequent occurrence, but occasionally the medium is rendered permanently acid. After three weeks the medium, if tubes are capped with rubber caps, may occasionally become thickened, or even real clotting, though of very rare occurrence, may take place.

Sugar broths and action on lactose.—The sugar reactions are collected in the following table. Some remarks may be made on the action of the germ on lactose; when the germ is freshly isolated from the stools or urine it has no action on lactose, but after several transplantations it may very slightly ferment this sugar at times, while it does not touch it at other times, using the usual technique with Durham tubes; the experiment has been repeated many times and all precautions have been taken to avoid mistakes as far as possible. It is notable that on Mackonkie's lactose red agar the colonies are always permanently white.

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	Motility.	Litmus Milk.*	Lactose.*	Saccharose.	Dulcite.	Mannite.	Glucose.	Maltose.	Dextrin.	Raffinose.	Arabinose.	Adonite.	Inulin.	Sorbite.	Galactose.	Laevulose.
B. Columbense (1905) ...	+	A vs. / Alk. D	O or AGS	O	A G	A G	A G	A G	As Gs	O	A G	O	O	A G	A G	A G

	Inosite.	Salicin.	Amygdalin.	Isodulcite.	Erythrite.	Glycerine.	Indole.	Voges-Prosk.	Redn : Nitrates.	Neutral Red.	Gram.	Gelatine.	Serum.	Broth.	Peptone Water.
B. Columbense (1905) ...	O	A G	O	A G	O	A G	+	O	O	O	O	O	O	G T P	G TPvs

Abbreviations used in this table :—A=acid, G=gas, C=clot, D=decolourized, Alk=alkaline, S=slight, A/alk=acid then alkaline, GT=general turbidity, P=pellicle, vs=very slight, O=negative result, viz. :—neither acid nor gas in sugar media, neither acid nor clot in milk, non-production of indole, non-motile or non-liquefaction of gelatine or serum, as the case may be, + =positive result, ‡=sometimes positive, sometimes negative.

Biological reactions.—Strain I. (1905) was agglutinated by the patient's blood in dilution up to 1 in 80. The strain was agglutinated also by the blood of the two recent cases (1913), in one up to a dilution of 1 in 40, in the other up to a dilution of 1 in 160. As I have already stated, the blood of none of these patients agglutinated *B. typhosus, paratyphosus A and paratyphosus B* even in a dilution of 1 in 20. Normal blood does not agglutinate the bacillus.

Strain II. (1913) was agglutinated by the blood of the patient from whom it was isolated in a dilution of 1 in 40, and from the blood of Case 3 (1913) in approximately the same dilution. Normal blood has no action on the germ.

Strain III. (1913) was agglutinated by the blood of the patient from whom it was isolated up to a dilution of 1 in 160. It could not be tested with the blood of Case 2. Normal blood does not agglutinate the strain.

Agglutination reactions with sera derived from hyperimmunized animals.—The following table shows the agglutination reactions of the three strains with sera derived from rabbits inoculated with them :—

Table.

Sera	Agglutination limits with Strain I	Strain II	Strain III
Serum of rabbit inoculated with Strain I.	1,000	800	800
Serum of rabbit inoculated with Strain II.	600	800	800
Serum of rabbit inoculated with Strain III.	600	500	600

These agglutination reactions, and the result also of some absorption tests, carried out, clearly show that the three strains are identical. Here it may be added that all three strains have been repeatedly tested with typhoid serum, paratyphoid A serum, paratyphoid B serum, derived from patients suffering and convalescent from such diseases, as well as from hyper-immunized animals, always with absolutely negative results, the tests being always negative, even using dilution of 1 in 20. The strains have been tested also with very powerful paratyphoid A and paratyphoid B sera obtained from the Berne Institute, with the same result, *viz.*, no agglutination whatever is observed. The absorption tests completely confirmed the agglutination tests. There cannot be any doubt, therefore, that the germ is neither

* See remarks in the text.

paratyphosus A nor paratyhosus B. The germ has been tested also with several different coli and coli-like sera I have prepared, always with negative results.

Botanical position of the Bacterium. This bacterium is difficult to classify, owing to its inconstant action on lactose. As already stated, all possible precautions to avoid a mistake have been taken, and the conclusion arrived at is that the same strain, while at times a non-lactose fermenter, at other times feebly ferments lactose with very slight production of gas. When it does not ferment lactose its sugar reactions are practically identical to those of *B. paratyphosus B*; when it ferments lactose it is closely related to *B. coli.* Agglutination and absorption tests clearly show that the germ is a separate species, as it is never agglutinated by paratyphoid A and B sera, even powerful ones as those imported from the Berne Institute, nor from any coli and coli-like serum I have prepared.

Bacterium columbense cannot be identified with *B. paratyphosus C* of Uhlenhuth, as the latter is culturally identical to *B. suipestifer*, and in man, at least, is apparently not pathogenic. It cannot, of course, be excluded that *B. columbense* may be identical with one of the so-called paratyphosus D, &c., paracolon bacilli, &c., isolated by certain authors, as I have not in my hands the whole series of such germs to enable me to carry out comparative researches : even if such were the case, however, according to the rules of nomenclature the term *B. columbense* (Cast. 1905) would have to stand, owing to priority of description and name.*

Vibrio Kegallensis.

This vibrio was isolated from stools of a patient of Kegalle, suffering from a cholera-like diarrhœa. True cholera being present at the time in other districts of the Island a very complete examination of the stools was carried out. No true cholera vibrois were found—instead a vibrio was isolated, of which I give here a brief description :

Microscopical examination.—Films from the stools stained with diluted fuchsin contained numerous vibrios, the same shape as the true cholera one, but somewhat larger.

Motility.—The vibrio is very motile, like the cholera vibrio.

Staining reactions.—Easily stained by the usual aniline dyes. Gram-negative.

Cultural characters.—On agar and gelatin the growth has a certain resemblance to true cholera. Gelatine is liquefied, serum is also liquefied, milk is rendered acid and clotted. The following table gives the principal cultural characteristics and sugar reactions of the micro-organism.

	Motility.	Litmus Milk	Lactose.	Saccharose.	Dulcite.	Mannite.	Glucose.	Maltose.	Dextrine.	Raffinose.	Arabinose.	Adonite.	Inulin.	Sorbite.	Galactose.
V. Kegallensis	++	A S	D/A S	A	O	A D	A	A	A	O D	A D	O D	O D	O D	A

	Laevulose.	Inosite.	Salicin.	Amygdalin.	Isodulcite.	Erythrite.	Glycerine.	Indole.	Voges-Prosk.	Redn : Nitrates.	Neutral Red.	Gram.	Gelatine.	Serum.	Broth.	Peptone Water.
V. Kegallensis	A	O	O	O	O	O	O	O	O	O	O	O	+	+	G T	G T

Abbreviations used in the table :—A=acid, S=slight, GT=general turbidity, D=decolourized, O=negative result, viz. :—neither acid nor gas in sugar media, neither acid nor clot in milk, non-production of indole, non-motile or non-liquefaction of gelatine or serum, as the case may be, +=positive result.

* I shall be pleased to supply workers interested in the subject with cultures of the micro-organism.

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Agglutination.—This vibrio is not agglutinated by true cholera serum.

Pathogenicity.—Much further investigation is necessary to see whether this germ is in reality pathogenic to man. It does not seem to be very pathogenic to the lower animals unless injected in large doses.

Conclusion.—This vibrio differs from the true cholera vibrio as shown by cultural characters and agglutination tests. I have suggested for it the term *Vibrio kegallensis.*

Further Researches on the Mixed Typhoid + Paratyphoid B + Paratyphoid A Vaccine.

In my previous report I gave the result of some experimental work on the mixed typhoid + paratyphoid A + paratyphoid B vaccine, the vaccine which I have used on a fairly large scale in Ceylon since 1908. The vaccine consists of an emulsion of typhoid and paratyphoid A. and B. bacilli killed by heat, and standardized so that one cubic centimetre contains approximately 500 millions of typhoid bacilli and 250 millions each of paratyphoid A. and B. For the first dose, half to 0·6 cubic centimetre should be injected with aseptic precautions under the skin, preferably in the arm. The inoculation is followed after three to four hours by some pain and tenderness at the site of injection, and in four to eight hours by fever (100° or 101°F.) and general malaise. All these symptoms have usually disappeared in thirty-six hours.

A second injection of from one to 1·2 cc. should be given seven to ten clear days after the first inoculation. It is often followed by a less local reaction. A third injection—the same dose as the second—may be given with advantage after a further interval of seven to ten days.

I have continued experiments on the production of agglutinins by this vaccine during the last six months. I give a table containing the complete agglutination results obtained in the individuals inoculated on the 14th June, 1913; this table completes the one given in my previous report. From the table it will be seen that the individuals inoculated with a mixed typhoid + paratyphoid A + paratyphoid B vaccine, produced agglutinins for all three germs, and that on the average the amount of agglutinins produced for each germ was not much smaller than in individuals inoculated with one germ only, although the latter had a much larger dose of the germ. As regards the length of time during which agglutinins were present in the inoculated individuals, the results did not differ much; if anything, they were rather in favour of the mixed vaccines. Although, of course, one cannot gauge the actual immunization obtained by simply studying the agglutination, there can be no doubt that to a certain extent agglutination is a rough index for immunization.

It seems to me that the same conclusion may be arrived at as in my previous reports, *viz.*, that it is highly advisable to use—instead of the usual simple typhoid vaccine—the mixed typhoid + paratyphoid A + paratyphoid B vaccine in countries where the three diseases are met with.

Limits of Agglutination.

Name.	Vaccine Used for Inoculation.		B. Typhosus. Weeks After 1st Inoculation. 1	2	3	4	5	6	7	8	9	11	13	15
David	Mixed	"Dead"	0	1/400	1/200	1/200	1/300	1/80	1/80	1/80	1/60	1/40	1/20	1/20
Fernando	,,	,,	0	1/500	1/200	1/200	1/300	1/300	1/100	1/80	1/80	1/40	1/20	1/20
Peter	Typhoid	,,	1/20	1/500	1/500	1/200	1/300	1/150	1/150	1/150	1/150	1/60	1/20	0
Singho	Paratyph : A	,,	0	0	0	0	0	0	0	0	0	0	0	0
Asson	Paratyph : B	,,	0	0	0	0	0	0	0	0	0	0	0	0
A. E. de Silva ...	Mixed	"Live"	1/20	1/300	1/500	1/200	1/200	1/100	1/100	1/80	1/60	1/20	1/20	0
D. C. P. Gunesekera	,,	,,	0	1/500	1/300	1/200	1/200	1/100	—	—	—	—	1/60	1/20
Isaac	Typhoid	,,	0	1/400	1/300	1/300	1/300	1/300	1/300	1/200	1/200	1/300	1/100	1/50
Wellan	Paratyph : A	,,	0	0	0	0	0	0	0	0	0	0	0	0
Karuppen	Paratyph : B	,,	0	0	0	0	0	0	0	0	0	0	0	—

Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

Name.	Vaccine Used for Inoculation.		B. Paratyphosus A. — Weeks After 1st Inoculation. 1	2	3	4	5	6	7	8	9	11	18	15
David	Mixed	"Dead"	0	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{100}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{20}$	$\frac{1}{20}$
Fernando	,,	,,	0	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{40}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{80}$	$\frac{1}{80}$	$\frac{1}{80}$	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{20}$
Peter	Typhoid	,,	0	0	0	0	0	0	0	0	0	0	0	0
Singho	Paratyph : A	,,	$\frac{1}{20}$	$\frac{1}{80}$	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{40}$	$\frac{1}{40}$	$\frac{1}{20}$	0
Asson	Paratyph : B	,,	0	0	0	0	0	0	0	0	0	0	0	0
A. E. de Silva ...	Mixed	"Live"	0	$\frac{1}{40}$	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	0	0
D. C. P. Gunesekera	,,	,,	0	$\frac{1}{60}$	$\frac{1}{40}$	$\frac{1}{40}$	$\frac{1}{40}$	$\frac{1}{40}$	—	—	—	—	$\frac{1}{40}$	$\frac{1}{20}$
Isaac	Typhoid	,,	0	0	0	0	0	0	0	0	0	0	0	0
Wellan	Paratyph : A	,,	0	$\frac{1}{100}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{60}$
Karuppen	Paratyph : B	,,	0	0	0	0	0	0	0	0	0	0	0	—

Name.	Vaccine Used for Inoculation.		B. Paratyphosus B. — Weeks After 1st Inoculation. 1	2	3	4	5	6	7	8	9	11	13	15
David	Mixed	"Dead"	0	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{60}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$
Fernando	,,	,,	0	$\frac{1}{40}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{40}$	$\frac{1}{40}$	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{40}$
Peter	Typhoid	,,	0	0	0	0	0	0	0	0	0	0	0	0
Singho	Paratyph : A	,,	0	0	0	0	0	0	0	0	0	0	0	0
Asson	Paratyph : B	,,	0	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	0	$\frac{1}{20}$
A. E. de Silva ...	Mixed	"Live"	0	$\frac{1}{40}$	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{20}$	0	0	0	0	0	0
D. C. P. Gunesekera	,,	,,	0	$\frac{1}{20}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{20}$	—	—	—	—	$\frac{1}{40}$	$\frac{1}{20}$
Isaac	Typhoid	,,	0	0	0	0	0	0	0	0	0	0	0	0
Wellan	Paratyph : A	,,	0	0	0	0	0	0	0	0	0	0	0	0
Karuppen	Paratyph : B	,,	0	$\frac{1}{20}$	$\frac{1}{80}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	0	0	0	—

Further Case of Entoplasmosis.

In my previous report I described a peculiar protozoal organism found in three cases of dysenteric colitis in which amœbæ and bacilli of the dysentery group were absent. Since then I have come across another case, a passenger from Burma. The patient complained of severe griping pains and diarrhœa with mucopus and blood in the stools. When I saw him these symptoms had started two days previously, on board. The temperature was 100°, general condition good : the stools contained a large amount of mucus, practically no fæcal matter I prescribed a saline mixture, and I directed the patient to pass a stool in a large sterile petri dish I supplied him with. A stool was examined microscopically thirty minutes after having been passed. Protozoal bodies identical to those described in my previous report were found. There is no need to give here again a full description of them, but I may mention again that these bodies were actively motile, with the body showing only slight changes of shape while moving, and no pseudopoda, and with the anterior portion extremely shaken—so to speak—by very rapid vibratory-like movements making one suspect at once the presence of flagelli. On closer examination no such organs were found, either in fresh or stained preparations. In this case, in addition to the Giemsa method of staining, I employed the Hydenheim iron hæmat, with, of course, previous wet fixing. One preparation so stained came out beautifully, showing clearly that the group of granular or coccus-like bodies observed in preparations stained with Giemsa is a nucleus, this confirming Professor Mesnil's opinion. No flagelli or cylia were visible. Of course, I do not deny that such organs may be present, but so far in none of my preparations have I been able to detect them, nor have any of my colleagues to whom I have shown the slides. How to

classify this organism? Professor Mesnil and all other authorities consider it a new organism, though differing in the zoological position to be given to it. Personally, I consider it to represent a new genus, for which I proposed in previous papers the term "Entoplasma."

A Probably New Type of Ulcerative Dermatitis.

Since several years I have noted in Ceylon a peculiar ulcerative condition of the skin affecting mostly Europeans, but until now I have never published my cases. Recently I have had the opportunity of studying more completely such condition of which I give here a brief account.

The disease starts with several superficial dusky-red, not raised, slightly itching spots, which are generally follicular and perifollicular: they are, as a rule, situated on the feet and legs. The patient usually takes these spots for mosquito-bites. Some of the spots disappear while others become slowly larger, raised, infiltrated, and often somewhat cupoliform; the size of a pea to a cherry; there is no pustulation; after a time the centre breaks down and an ulcer forms with reddish fundus and undermined edges. (See photograph.*)

These ulcerative lesions are somewhat painful and very slow to heal, complete spontaneous cure seldom taking place in less than four to six months; on healing, patches of hyperpigmentation often remain.

Etiology.—If the initial dusky-red follicular non-elevated spots are pricked and a droplet of blood collected and films made, one only sees numerous red blood cells with few leucocytes and here and there a few cocci arranged in pairs. If agar tubes are inoculated a streptococcus-like germ grows in pure culture from the non-ulcerated lesions, while from the ulcerated lesions staphylococci and other germs may be grown in addition to the streptococcus. This streptococcus is biologically different from the usual streptococci, and I have named it *Streptococcus tropicalis*. I give in the following table its principal characters.

	Motility.	Litmus Milk.	Lactose.	Saccharose.	Dulcite.	Mannite.	Glucose.	Maltose.	Dextrine.	Raffinose.	Arabinose.	Adonite.	Inulin.	Sorbite.
Streptococcus tropicalis ...	O	A	A	A	O	O	A	A	A	O	A	O	A	O

	Galactose.	Laevulose.	Inosite.	Salacin.	Amygdalin.	Isodulcite.	Erythrite.	Glycerine.	Indole.	Voges Prosk.	Redu: Nitrates.	Gram.	Gelatine.	Serum.
Streptococcus tropicalis ...	A	A	O	A	O	O	O	O	O	O	O	+	O	O

Abbreviations used in the table:—A=acid, C=clear, +=positive result, O=negative result, viz.:—neither acid nor gas in sugar media, non-production of indole, non-motile, non-liquefaction of gelatine or serum, as the case may be.

The malady may be experimentally reproduced by inoculating pure cultures of the germ into the hair follicles, or around them, by means of a very fine needle, provided a recently isolated strain be used.

Diagnosis.—The affection, when well developed, is recognizable by the presence of raised, hard, rather large nodules, cupoliform with central ulcer, presenting undermined edges. The affection must be distinguished from *Pyosis tropica*, ecthyma, purulent folliculitis, veldt sore, barkoo rot, oriental sore, blastomycosis, ulcers of syphilitic origin, &c. In *Pyosis tropica* the ulcers do not show undermined margins. In ecthyma there are initial discrete flat pustules with inflamed haloes, and the margins of the ulcers are not, as a rule, undermined. The absence of leishmania distinguishes at once the affection I have described from oriental sore; and the absence microscopically and culturally of fungi separates the disease from blastomycosis, apart from different clinical signs.

The microscopical examination and the utter uselessness of mercury, potassium iodide, and salvarsan, distinguishes the affection from syphilitic lesions. In barkoo rot the crust covering the ulcer is very hard and difficult to remove. In *Ulcus infantum* a diphtheria-like germ is found. In veldt sore the ulcerative lesions are generally very superficial and the edges of the lesions are not undermined and the exudation

* Not reproduced.

dries into a thin crusty mass. In purulent folliculitis of the legs there are no ulcers but numerous pustules, each pierced by a hair. The affection I have described might be called *dermatitis ulcerativa tropica* or *dermatitis cupolifornus.*

Treatment.—Treatment with antiseptic lotions (hydr. perch., hydr. perox, &c.) followed by a balsam of Peru ointment, though useful, is very slow in its effects. The best treatment is by far the use of an autogenous vaccine. Cases which have resisted external treatment for six months may become cured practically in a few days.

Peculiar Skin Disease with Gummata-like Swellings due to a Fungus.

This disease (see photographs*) was observed in a planter who had resided for many years in Ceylon. When I saw the patient the affection was dating from about two years, and practically the whole body was covered with numerous ulcers and some nodules with the appearance of gummata. These swellings were rather hard: on opening them a sort of slough could be removed; none apparently had undergone a true suppurative change. The patient had had a very energetic mercurial treatment without receiving any benefit. He denied ever having had syphilis, and the Wasserman test taken two months after discontinuing the mercury had been negative.

Bacteriological examination.—The skin of one of the non-ulcerated swellings was painted with tinc. iodine, then an incision made, and a large slough-like portion of tissue removed aseptically from the inside. It was divided into small portions, each of which was sown into glucose broths and glucose agars. A fungus was grown, the complete study of which has not yet been finished; it grows best on glucose agar giving rise to large colonies of a greyish-greenish colour. Microscopically a large amount of mycelial elements are seen, while free spores seem to be absent. I have been unable so far to classify this fungus, the investigation of which, as already stated, is in the preliminary stage.

The "Yellow Disease": A Peculiar Skin Pigmentation.

I have seen three cases of an extremely peculiar yellow pigmentation of the skin in Europeans, called by the patients the "yellow disease." The first case, which I observed nearly ten years ago, was a planter, the other two cases were a European lady and her baby eighteen months old. The face, arms, hands, and at times practically the whole body, is of a bright yellow or saffron colour. The pigmentation was in my cases most marked on the palms of the hands, arms and face. The yellow colour, as already stated, is bright yellow or saffron yellow or even canary yellow, and quite different from the yellow colour of jaundice. The sclerotiæ remain completely white, the urine is of normal colour and composition, the sweat is not coloured, the stools are of normal colour, in fact, the general health is in no way affected, but, naturally, the patients object to the disfigurement. In the case of the lady and her child the pigmentation disappeared every time on going to the hills, to reappear again in a few days after coming back to Colombo. The pigmentation has recently gradually disappeared, though not completely.

Etiology.—This is absolutely unknown. A parasitic cause was at first suspected, but no pigment-producing germ of any kind has been found.

Diagnosis.—As already stated, the bright yellow colour is quite different from what one sees in jaundice, moreover the sclerotiæ remain white, the urine and stools are of a normal colour, the condition of the liver is normal, and the general health quite good. My patients do not appear to have been cases of chromidrosis, as the sweat was not coloured and the clothes were not stained by it.

In *Xantoderma areatum*, a condition I described some years ago, the yellow patches remain localized to the legs, and are permanent. In ochronosis, which is generally congenital, there is alcaptonuria and the ligaments and cartilages become blackened. In *tinea flava* a fungus is present.

Treatment.—On the hypothesis that the condition might be parasitic I advised my patients to use a formalin spirit lotion (1 per cent.) regularly. They thought it slightly improved the condition, but I could not satisfy myself that it was really so. The only successful measure seems to be to send the patients up-country, where the pigmentation disappears almost completely.

Aldo Castellani.

* Not reproduced.

Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

No. 5.

CEYLON.

The GOVERNOR to the SECRETARY OF STATE.

(Received 25th August, 1914.)

Sir, The Queen's House, Colombo, Ceylon, 3rd August, 1914.

With reference to my despatch of 21st February, 1914,* I have the honour to forward herewith, for transmission to the Advisory Committee of the Tropical Research Fund, a report by Dr. Aldo Castellani on research work carried out at the Clinic for Tropical Diseases and Bacteriological Institute during the period from 1st January to 30th June, 1914.

I have, &c.,
ROBERT CHALMERS,
Governor, &c.

Enclosure in No. 5.

Report on Investigation Work carried out at the Clinic for Tropical Diseases and Bacteriological Institute, from 1st January to 30th June, 1914, by Aldo Castellani, M.D., Director, Clinic for Tropical Diseases and Bacteriological Institute, Colombo, Ceylon.

During the last six months the routine work of the Bacteriological Institute has been even heavier than usual—this being due to the outbreak of plague in Colombo—and has practically occupied the whole of my official time. I have been able, however, to do some further research work—mostly outside office hours—on the following subjects :—

1. Combined vaccinations;
2. Fungi found in sprue.

I wish to express my indebtedness to Mr. E. Burgess, Assistant Bacteriologist, for the valuable assistance rendered. My thanks are also due to Mr. K. Vallipuram and Mr. W. R. De Silva, Laboratory Assistants to the Bacteriological Institute.

Combined Vaccinations.

Since 1905 I have prepared and used in man several combined vaccines, basing their preparation on the experimental work I carried out in Bonn in Professor Kruse's Laboratory during the years 1901-1902. I succeeded then in demonstrating that an animal (rabbit) inoculated with two different bacteria produced, at the same time, agglutinins and immune bodies for both; and that, provided a sufficient minimum quantity had been inoculated, the amount of agglutinins and immune bodies elaborated for each germ was about the same as in animals inoculated with one germ only. Moreover, I demonstrated that inoculating an animal (rabbit) with three different germs (*B. typhosus B*, *B. pseudodysentericus* No. 1 (Kruse), strain of *B. coli communis*) the amount of agglutinins and immune bodies elaborated for each germ is nearly the same as in animals respectively inoculated with one species only. In rabbits I found that by inoculating more than three species of micro-organisms no good results were obtained, but—in view of my recent work—if I had used animals of larger size, I might, and probably should, have found that good results can be obtained even using more than three species. I showed that when immunization is obtained by a single inoculation, provided the minimum dose sufficient to obtain the maximum immunization be given, the amount of agglutinins and immune bodies elaborated by the inoculated animals is not in proportion to the amount of cultures injected. A series of rabbits inoculated with 2 c.c. of typhoid culture will give the same average agglutination limit, and the same amount of immune bodies, as a series of rabbits inoculated with 4 c.c.

Combined "Typhoid—Paratyphoid A—Paratyphoid B" Vaccine.

Since 1905 this vaccine has been extensively used by me with good results. Having already published several reports and papers on it (Centr. f. Bakt. 1909 and

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* No. 4.

1913, British Medical Journal, 1913, etc.) I will limit myself to state here that my further investigation has confirmed my previous work, viz.: that this combined vaccine is harmless; that it gives a certain amount of protection for the three diseases; and that it is advisable to use it always instead of the simple typhoid vaccine in countries where paratyphoid A and B occur, besides typhoid. The advisability of using such a vaccine is shown by the fact that I have seen two cases of persons inoculated with simple typhoid vaccine before sailing from Europe, developing paratyphoid A three months after landing in Ceylon: the diagnosis being made by hæmoculture. Moreover, cases of mixed infection, typhoid and paratyphoid A or paratyphoid B, do occur, though not frequently. As a matter of fact, I have recently observed a case, which must be extremely rare, of contemporaneous triple infection: typhoid, paratyphoid A, and paratyphoid B. I hope soon to publish this case in detail, but I do not think there can be any doubt about the diagnosis, as the stools contained the three germs, the blood gave a strong agglutination for all three, and the absorption test showed that there were present specific agglutinins for each germ.

In previous reports I have given in detail the technique for the preparation of such vaccine: it suffices here to state that the vaccine consists of an emulsion of typhoid and paratyphoid A and B bacilli, killed by heat (53° C.) and standardized so that one cubic centimetre contains approximately 500 millions of typhoid bacilli, and 250 millions each of paratyphoid A and B. The vaccine may be prepared also without heating by emulsions from agar cultures in 0·75 per cent. salt solution to which 0·75 per cent. of carbolic has been added: the presence of 0·5 per cent. carbolic is sufficient to kill the germs. For the first dose 0·5 to 0·6 cubic centimetre should be injected with aseptic precautions under the skin, preferably in the arm. The inoculation is followed after three to four hours by some pain and tenderness at the site of injection, and in a few hours more by fever (100 or 101° Fahr.) and general malaise. All these symptoms have usually disappeared in 36 hours. A second injection of from 1 to 2 c.c. should be given seven to ten clear days after the first inoculation. It is often followed by less local reaction. A third injection (the same dose as the second) may be given with advantage after a further interval of seven to ten days.

Combined "Cholera-Plague" Vaccine.

On this combined vaccine I will say here only a few words, having already published the details of its preparation, etc., elsewhere. Given the presence in Ceylon at the same time of both cholera and plague, it occurred to me to prepare a combined cholera-plague vaccine, which should contemporarily give a certain amount of immunization for both diseases. The combined cholera-plague vaccine I prepare consists of an emulsion in carbolized ($\frac{1}{2}$ per cent.) normal salt solution, of plague bacilli and cholera vibrios from three days old cultures, standardized so that 1 c.c. of the emulsion contains approximately one thousand millions of plague bacilli, and two thousand millions of cholera vibrios. Of this vaccine, in adults, one c.c. is inoculated the first time, subcutaneously in the arm, and two c.c. the second time, a week after the first injection. To date, 250 individuals have been so inoculated. I can confirm the conclusions I came to in my previous papers, viz.:—

1. The inoculation of the vaccine in the lower animals induces a production of protective substances for the plague bacillus and the cholera vibrio.

2. The inoculation of such vaccine in human beings is harmless: the reaction is rather less marked than after the inoculation of Haffkine, but more severe than after Lustig's vaccine.

3. A small amount of agglutinins, both for plague and cholera, appear in the blood of most of the inoculated persons. The agglutination for the plague bacillus is generally very slight (one in ten, one in twenty, or nil), but this is also the case when using a simple plague vaccine such as Haffkine's or Lustig's. The agglutination for cholera varies between the limits 1 in 20 and 1 in 60 (rarely higher) and is practically the same as in individuals inoculated with cholera vaccine only (see tables).

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Combined "Typhoid—Paratyphoid A—Paratyphoid B—Plague-Cholera" Vaccine.

This combined "five diseases" vaccine consists of a carbolized emulsion of typhoid, paratyphoid A, and paratyphoid B bacilli; cholera vibrios; and plague bacilli. The technique of its preparation is as follows:—

Agar cultures twenty-four hours' old are used in the case of typhoid, paratyphoid A, paratyphoid B, and cholera: agar cultures three days' old are used in the case of plague, as this germ grows slowly.

The growth of the typhoid agar cultures is washed off with 0·75 per cent. salt solution containing 0·5 per cent. carbolic acid; is stored at room temperature 18-24 hours and then tested for sterility and standardized in such a way that 1 c.c. of this carbolized typhoid vaccine will contain approximately one thousand millions of typhoid bacilli. The same procedure is carried out with paratyphoid A, paratyphoid B, and plague: each of these carbolized vaccines will, therefore, contain one thousand million germs per each c.c. The same technique is used to prepare the cholera vaccine, but this vaccine is standardized in such a way as to make it contain four thousand millions per c.c. After having prepared, standardized, and tested for sterility these five different vaccines, they are mixed together in the following proportions:—

Cholera	vaccine	2 parts	2 c.c.
Plague	do.	2 ,,	2 c.c.
Typhoid	do.	2 ,,	2 c.c.
Paratyphoid A	do.	1 ,,	1 c.c.
Paratyphoid B	do.	1 ,,	1 c.c.

The mixed vaccine will, therefore, contain per c.c.:—

Cholera	1,000 millions.
Plague	250 ,,
Typhoid	250 ,,
Paratyphoid A	125 ,,
Paratyphoid B	125 ,,

Method of Vaccination.

The inoculation is made subcutaneously in the arm, in the same manner as when using simple typhoid vaccine. In strong adults I give 1 c.c. the first time, and 2 c.c. a week later; in adults who do not appear to be very strong, or in individuals who fear the reaction, as also in women, I give half doses, viz., ½ c.c. the first time and 1 c.c. the second time. Children between 10 and 16 years receive one-third the adult dose. Children under 10 years of age I have not yet inoculated. The inoculation of the vaccine is followed in a few hours by a local reaction (redness and some infiltration) and general reaction (fever malaise, rheumatoid pains) which generally does not incapacitate one for work for more than twenty-four hours. The reaction may be said to be, as a rule, more severe than after the inoculation of simple typhoid, or the mixed typhoid—paratyphoid A—paratyphoid B, vaccine; a little severer also than after the inoculation with Lustig's simple plague vaccine; but certainly somewhat less severe, in my experience, than after using Haffkine's simple plague vaccine. It is to be noted that occasionally one comes across individuals who do not show practically any reaction.

Innocuity of the mixed "five diseases" vaccine.

Four persons who volunteered have been inoculated nine times at a week's interval with 1 c.c. the first time and 2 c.c. on all the following occasions. They have remained in good general health, though two have had somewhat severe general and local reactions. One person, who also volunteered, has been inoculated with a double strength mixed vaccine four times—a vaccine which per c.c. contained double the amount of germs than the one generally used. Apart from a more severe local reaction no untoward effects were noted.

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Immunization obtained in Man by the combined "five diseases" vaccine.

Lack of time has prevented the study of the amount of all protective substances produced in inoculated individuals. The investigation, therefore, has been limited to studying the amount of agglutinins produced in individuals inoculated with the mixed five diseases vaccine, and comparing the results with those noted in individuals inoculated with simple "one disease" vaccines. Of course, one cannot gauge the actual immunization obtained by simply studying the agglutinins, but it is generally admitted that to a certain extent agglutination is a rough index for immunization. The results are collected in the following tables:—

Table No. I.

COMBINED "TYPHOID + PARA-TYPHOID A. + PARA-TYPHOID B. + CHOLERA + PLAGUE" VACCINE (TWO INOCULATIONS: 1C.C. THE FIRST, 2C.C. THE SECOND).

Name.	Blood Tested Against.	Limits of Agglutination—Weeks after 1st Inoculation.								
		1	2	4	5	7	8	9	10	11
Kuppaswamy ...	B. Typhosus ...	$\frac{1}{40}$	$\frac{1}{1200}$	$\frac{1}{300}$	$\frac{1}{150}$	$\frac{1}{100}$	$\frac{1}{60}$	$\frac{1}{100}$	$\frac{1}{60}$	$\frac{1}{40}$
	B. Para-Typh. A....	$\frac{1}{20}$	$\frac{1}{300}$	$\frac{1}{250}$	$\frac{1}{150}$	$\frac{1}{50}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{40}$	$\frac{1}{20}$
	B. Para-Typh. B....	$\frac{1}{20}$	$\frac{1}{250}$	$\frac{1}{200}$	$\frac{1}{100}$	$\frac{1}{50}$	$\frac{1}{40}$	$\frac{1}{60}$	$\frac{1}{20}$	$\frac{1}{20}$
	V. Cholera ...	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{30}$	0	0	0	0	0
	B. Pestis	0	$\frac{1}{20}$	0	0	0	0	0	0	0
Periaswamy ...	B. Typhosus ...	$\frac{1}{40}$	$\frac{1}{1000}$	$\frac{1}{300}$	$\frac{1}{200}$	$\frac{1}{100}$	$\frac{1}{100}$	$\frac{1}{150}$	$\frac{1}{100}$	$\frac{1}{60}$
	B. Para-Typh. A....	$\frac{1}{20}$	$\frac{1}{250}$	$\frac{1}{250}$	$\frac{1}{150}$	$\frac{1}{100}$	$\frac{1}{40}$	$\frac{1}{60}$	$\frac{1}{20}$	$\frac{1}{20}$
	B. Para-Typh. B....	$\frac{1}{20}$	$\frac{1}{150}$	$\frac{1}{80}$	$\frac{1}{150}$	$\frac{1}{50}$	$\frac{1}{40}$	$\frac{1}{60}$	$\frac{1}{20}$	0
	V. Cholera ...	$\frac{1}{20}$	$\frac{1}{300}$	$\frac{1}{200}$	$\frac{1}{150}$	$\frac{1}{150}$	$\frac{1}{40}$	$\frac{1}{20}$	0	0
	B. Pestis	0	0	$\frac{1}{20}$	$\frac{1}{20}$	0	0	0	0	0

Table No. II.

VACCINATION WITH COMBINED PLAGUE + CHOLERA VACCINE (TWO INOCULATIONS: 1C.C. THE FIRST, 2C.C. THE SECOND).

Individuals Inoculated.	Blood Tested Against.	Limits of Agglutination—Weeks after 1st Inoculation.						
		1	2	3	4	5	6	7
Tamil coolie No. 3	B. Pestis	0	$\frac{1}{20}$	0	0	—	0	0
	Vibrio Choleræ ...	0	$\frac{1}{40}$	$\frac{1}{40}$	0	—	0	0
Tamil coolie No. 4	B. Pestis	0	$\frac{1}{20}$	$\frac{1}{20}$	0	0	0	0
	Vibrio Choleræ ...	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{80}$	$\frac{1}{60}$	0	$\frac{1}{20}$	0
Tamil coolie No. 5	B. Pestis	0	0	0	0	0	0	0
	Vibrio Choleræ ...	0	$\frac{1}{20}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{20}$	0	$\frac{1}{20}$

Table No. III.

VACCINATION WITH SIMPLE PLAGUE VACCINE (HAFFKINE—ONE INOCULATION OF 4C.C.).

Individuals Inoculated.	Limits of Agglutination for B. Pestis—Weeks after 1st Inoculation.							
	1	2	3	4	5	6	7	8
Tamil coolie No. 6	0	$\frac{1}{20}$	$\frac{1}{20}$	0	—	—	0	—
Singhalese No. 1...	0	0	0	—	—	—	0	—

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Table No. IV.

Vaccination with Simple Plague Vaccine (Lustig's—three inoculations).

Individuals Inoculated.	Limits of Agglutination for B. Pestis—Number of weeks after 1st Inoculation.					
	1	2	3	4	5	6
Tamil coolie No. 7	0	0	$\frac{1}{20}$	$\frac{1}{20}$	—	0
Tamil coolie No. 8	0	$\frac{1}{20}$	0	$\frac{1}{20}$	0	0
Tamil coolie No. 9	0	0	0	—	—	0

Table No. V.

Vaccination with Simple Plague Vaccine (Carbolized, two inoculations : 1c.c the first, 2c.c. the second).

—	Limits of Agglutination for B. Pestis—Number of weeks after Inoculatian.						
	1	2	3	4	5	6	7
Singhalese No. 2	0	0	—	—	0	—	0
Tamil coolie No. 10	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	0	$\frac{1}{20}$	0	0

Table No. VI.

Vaccination with Simple Carbolized Cholera Vaccine (two inoculations : 1c.c the first, 2c.c. the second).

—	Limits of Agglutination for V. Choleræ—Weeks after 1st Inoculation.					
	1	2	3	4	5	6
Tamil coolie No. 11	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{20}$	$\frac{1}{20}$	0	0
Tamil coolie No. 12	0	$\frac{1}{40}$	$\frac{1}{40}$	0	$\frac{1}{20}$	0
Tamil coolie No. 13	$\frac{1}{20}$	$\frac{1}{80}$	—	$\frac{1}{60}$	$\frac{1}{20}$	0

Table No. VII.

Vaccination with Simple Typhoid Vaccines (two inoculations : 0·6c.c. the first, 1·2c.c. the second).

—	Limits of Agglutination for B. Typhosus—Weeks after 1st Inoculation.										
	1	2	3	4	5	6	7	8	9	10	11
Singhalese No. 3 (carbolized vaccine) ...	$\frac{1}{20}$	$\frac{1}{800}$	$\frac{1}{300}$	$\frac{1}{200}$	$\frac{1}{200}$	—	$\frac{1}{100}$	—	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{60}$
Singhalese No. 4 (ordinary heated vaccine) ...	$\frac{1}{20}$	$\frac{1}{500}$	$\frac{1}{500}$	$\frac{1}{200}$	$\frac{1}{300}$	$\frac{1}{150}$	$\frac{1}{150}$	$\frac{1}{150}$	$\frac{1}{150}$	—	$\frac{1}{60}$

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Table No. VIII.

Vaccination with Simple Paratyphoid A. Vaccines (two inoculations: $\frac{1}{2}$c.c. the first, 1c.c. the second).

—	Limits of Agglutination for B. Paratyphosus A.—Weeks after 1st Inoculation.										
	1	2	3	4	5	6	7	8	9	10	11
Tamil "Singho" ...	$\frac{1}{20}$	$\frac{1}{80}$	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{40}$	—	$\frac{1}{40}$
Singhalese "Wellan" ...	O	$\frac{1}{100}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{60}$	—	$\frac{1}{60}$

Table No. IX.

Vaccination with Simple Paratyphoid B. Vaccines (two inoculations: 0·6c.c. the first, 1·2c.c. the second).

—	Limits of Agglutination for B. Paratyphosus B.—Weeks after 1st Inoculation.										
	1	2	3	4	5	6	7	8	9	10	11
Singhalese "Assou" ...	O	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	—	$\frac{1}{20}$
Tamil "Karuppen" ...	O	$\frac{1}{20}$	$\frac{1}{80}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{20}$	$\frac{1}{20}$	$\frac{1}{20}$	O	—	O

From the above tables it will be seen that the two individuals inoculated with the combined "five diseases" vaccine produced agglutinins in large amount for typhoid, paratyphoid A and paratyphoid B; in small amount for cholera, and in very small amount for plague.

If we compare these results with those obtained in individuals respectively inoculated with simple typhoid vaccine, paratyphoid A vaccine, paratyphoid B vaccine, cholera vaccine and plague vaccine, we see that the amount of agglutinins produced in the latter is not distinctly larger. In the control individuals inoculated with simple typhoid, paratyphoid A, paratyphoid B vaccines, the amount of agglutinins for such germs does not seem to be much higher; in individuals inoculated with simple cholera vaccine the amount of agglutinins present is small, in individuals inoculated with simple plague vaccine, whatever kind of vaccine is used (carbolized, Lustig's, or Haffkine's), it is also very small or absent.

Combined "Typhoid-Malta Fever" Vaccine.

This vaccine consists of an emulsion in carbolized ($\frac{1}{2}$ per cent.) normal salt solution (0·75 per cent.) of typhoid bacillus and *Micrococcus melitensis.* Agar cultures twenty-four hours' old are used in the case of typhoid; agar cultures three days' old in the case of Malta fever. The growth of the typhoid agar cultures is washed off with 0·75 per cent. salt solution containing 0·5 per cent. carbolic acid, is stored at room temperature 18-24 hours, and then tested for sterility and standardized in such a way that 1 c.c. will contain approximately 1,000 millions of typhoid bacilli. The same technique is used to prepare the Malta fever vaccine, but such vaccine is standardized so as to contain 4,000 millions per c.c. These two vaccines are mixed together in equal parts: the combined vaccine will contain per c.c. 500 millions typhoid and 2,000 millions Malta fever. I have inoculated this vaccine in eleven individuals with no untoward symptoms. The reaction is hardly more severe than after the inoculation of simple vaccine. I have not studied the agglutination week by week, as I have done in other combined vaccines, but the blood of inoculated individuals develops a large amount of agglutinins for the typhoid bacillus, and a certain amount of agglutinins for the Malta fever.

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Combined "Typhoid—Paratyphoid B—Paratyphoid A—Malta Fever" Vaccine.

This vaccine consists of an emulsion in carbolized ($\frac{1}{2}$ per cent.) salt solution (0·75 per cent.) of typhoid, paratyphoid A, paratyphoid B bacilli, and *Micrococcus melitensis.* Agar cultures twenty-four hours' old are used in the case of the first three germs mentioned; agar cultures three days' old of Malta fever. The growth of the typhoid agar cultures is washed off with 0·75 per cent. salt solution containing 0·5 per cent. carbolic acid, is stored at room temperature 18-24 hours, and then tested for sterility and standardized in such a way that 1 c.c. will contain approximately 2,000 millions typhoid. The same technique is used to prepare the paratyphoid A and paratyphoid B vaccines, each of these being standardized to contain 1,000 millions. The same technique is used to prepare the Malta fever vaccine, but this vaccine is standardized in such a way as to contain 4,000 millions per c.c.

After having standardized and tested for sterility these four different vaccines, they are mixed together in equal parts. Each c.c. of the mixture will contain the following:—

Typhoid	500 millions.
Paratyphoid A	250 ,,
Paratyphoid B	250 ,,
Malta fever	1,000 ,,

Of this vaccine 0·5 to 0·6 c.c. is injected subcutaneously in the arm the first time, and 1 c.c. to 1·2 c.c. the second time, after a week.

I have used this vaccine in a fairly large number of persons. I may say that the reaction was hardly severer than after the simple typhoid or mixed typhoid paratyphoid A and paratyphoid B vaccines. The blood of all the inoculated persons developed a large amount of agglutinins for typhoid, paratyphoid B, and paratyphoid A, and a certain amount for Malta fever. The amount of agglutinins produced for each germ was apparently not distinctly less than in control individuals inoculated with simple "one disease" vaccines. (See tables).

Table No. X.

Vaccination with "Typhoid + Paratyphoid A + Paratyphoid B + Malta Fever" Vaccine (two inoculations: 0·5 to 0·6c.c. the first time, 1 to 1·2c.c. the second time).

Names of Inoculated Individuals.	Agglutination for	Agglutination limits—Weeks after 1st Inoculation							
		1	2	3	4	5	6	7	8
Hamy	Typhoid	0	$\frac{1}{400}$	$\frac{1}{400}$	$\frac{1}{400}$	$\frac{1}{200}$	$\frac{1}{200}$	$\frac{1}{150}$	$\frac{1}{150}$
	Paratyphoid A. ...	0	$\frac{1}{200}$	$\frac{1}{150}$	$\frac{1}{150}$	$\frac{1}{150}$	$\frac{1}{100}$	$\frac{1}{100}$	$\frac{1}{100}$
	Paratyphoid B. ...	0	$\frac{1}{300}$	$\frac{1}{100}$	$\frac{1}{100}$	$\frac{1}{100}$	$\frac{1}{80}$	$\frac{1}{80}$	$\frac{1}{80}$
	Malta fever	0	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{100}$	$\frac{1}{150}$	$\frac{1}{80}$	$\frac{1}{100}$	$\frac{1}{100}$
Wellan No. 2 ...	Typhoid	0	$\frac{1}{600}$	$\frac{1}{500}$	$\frac{1}{500}$	$\frac{1}{300}$	$\frac{1}{200}$	$\frac{1}{200}$	$\frac{1}{150}$
	Paratyphoid A. ...	0	$\frac{1}{200}$	$\frac{1}{200}$	$\frac{1}{100}$	$\frac{1}{100}$	$\frac{1}{80}$	$\frac{1}{80}$	$\frac{1}{60}$
	Paratyphoid B. ...	0	$\frac{1}{200}$	$\frac{1}{150}$	$\frac{1}{100}$	$\frac{1}{100}$	$\frac{1}{100}$	$\frac{1}{80}$	$\frac{1}{80}$
	Malta fever	0	$\frac{1}{20}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{100}$	$\frac{1}{100}$	$\frac{1}{80}$	$\frac{1}{80}$

Table No. XI.

Vaccination with Simple Malta Fever Vaccine (two inoculations: 0·6c.c. the first time, 1·2c.c. the second).

Names of Inoculated Individuals.	Agglutination limits for M. Melitesnis—Weeks after 1st Injection.							
	1	2	3	4	5	6	7	8
Suppen (Tamil)	0	$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{60}$	$\frac{1}{80}$	$\frac{1}{80}$	$\frac{1}{60}$	$\frac{1}{60}$
Mr. S. (European)	0	0	$\frac{1}{40}$	$\frac{1}{120}$	$\frac{1}{150}$	$\frac{1}{100}$	$\frac{1}{80}$	$\frac{1}{100}$

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Combined "Typhoid—Paratyphoid A—Paratyphoid B—B. columbensis—B. asiaticus" Vaccine.

There being in Ceylon cases of fever due to *B. columbensis* and *B. asiaticus*, I have prepared a combined vaccine containing also these two germs. This vaccine consists of an emulsion in carbolized (½ per cent.) salt solution (0·75 per cent.) of typhoid, paratyphoid A, paratyphoid B bacilli, *B. asiaticus* and *B. columbensis.*

The individual carbolized vaccines are prepared as stated in previous paragraphs and standardized as follows :—

Typhoid	2,500	millions per c.c.
Paratyphoid A	1,000	,, ,,
Paratyphoid B	1,000	,, ,,
Asiaticus	1,000	,, ,,
Columbensis	1,000	,, ,,

These vaccines are mixed together in equal parts so that each c.c. of the combined vaccine will approximately contain :—

Typhoid	500	millions.
Paratyphoid A	200	,,
Paratyphoid B	200	,,
Asiaticus	200	,,
Columbensis	200	,,

Of this combined vaccine 0·5 to 0·6 c.c. is inoculated the first time and 1 c.c. to 1·2 c.c. the second time, a week later. The reaction is not much more severe than after a simple typhoid or typhoid-paratyphoid vaccination. The inoculated individuals develop a large amount of agglutinins of typhoid, paratyphoid A and paratyphoid B, practically in the same amount as control individuals inoculated with simple "one disease" vaccines. Agglutinins for *B. asiaticus* and *columbensis* are, however, present in most cases in not very large amount, and may soon disappear.

Combined "Typhoid—Paratyphoid A—Paratyphoid B—Micrococcus Melitensis—B. columbensis—B. asiaticus" Vaccine.

This vaccine consists of an emulsion in carbolized (½ per cent.) salt solution (0·75 per cent.) of typhoid bacilli, paratyphoid A, paratyphoid B bacilli, *B. asiaticus, B. columbensis*, Malta fever micrococcus.

The individual vaccines are prepared as described in previous paragraphs and standardized as follows, per c.c. :—

Typhoid	2,400	millions.
Paratyphoid A	1,000	,,
Paratyphoid B	1,000	,,
Asiaticus	1,000	,,
Columbensis	1,000	,,
Malta fever	4,000	,,

These vaccines are mixed in equal parts. The combined "six diseases" vaccine will, therefore, contain per c.c. :—

Typhoid	400	millions.
Paratyphoid A	166	millions (about).
Paratyphoid B	166	,,
Asiaticus	166	,,
Columbensis	166	,,
Malta fever	666	,,

I have inoculated numerous persons with this combined vaccine 0·5 to 0·6 c.c. the first time and 1 to 1·2 c.c. the second time, a week later. The inoculated persons have developed a large amount of agglutinins for typhoid, paratyphoid A and paratyphoid B, in fact, the large amount of agglutinins for *B. paratyphosus A* and *B. paratyphosus B* is indeed remarkable, being higher than in control individuals inoculated with simple paratyphoid A and paratyphoid B vaccines; a certain amount for Malta fever. Agglutinins for *B. asiaticus and B. columbensis* were produced in fairly large quantity but soon disappeared. This, however, is apparently the case also with control individuals inoculated with simple *B. columbensis* and *B. asiaticus* vaccines.

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Table No. XII.

Typhoid + Paratyphoid A. + Paratyphoid B. + Malta Fever + B. Columbensis + B. Asiaticus.

Names of Inoculated Individuals.	Agglutination for	Agglutination limits—Weeks after 1st Inoculation.					
		1	2	3	4	5	6
Subetheris (Singhalese)	Typhoid	O	1/600	1/500	1/400	1/400	1/200
	Paratyphoid A. ...	O	1/500	1/300	1/300	1/300	1/300
	Paratyphoid B. ...	O	1/500	1/500	1/500	1/300	1/200
	Malta fever	O	1/20	1/20	1/50	1/100	1/100
	B. Columbensis ...	O	1/100	1/100	1/50	1/40	O
	B. Asiaticus ...	O	1/50	1/100	1/100	1/50	1/60
Mr. D. (European)	Typhoid	1/20	1/500	1/500	—	—	1/400
	Paratyphoid A. ...	O	1/400	1/400	—	—	1/200
	Paratyphoid B. ...	O	1/400	1/400	—	—	1/200
	Malta fever	O	O	1/20	—	—	1/50
	B. Columbensis ...	O	1/150	1/50	—	—	O
	B. Asiaticus ...	O	1/300	1/200	—	—	1/60

Table No. XIII.

Vaccination with simple B. Columbensis Vaccine (two inoculations).

Inoculated Individuals.	Agglutination limits—Weeks after 1st Injection.					
	1	2	3	4	5	6
Tamil coolie No. 14	1/20	1/100	1/50	1/50	1/40	1/20
Tamil coolie No. 15	O	1/100	1/100	1/40	1/40	O

Table No. XIV.

Vaccination with simple B. Asiaticus Vaccine (two inoculations: 0·6c.c. the first time, 1·2c.c. the second).

Inoculated Individual.	Agglutination Limits—Weeks after 1st Injection.					
	1	2	3	4	5	6
Tamil coolie No. 16	1/20	1/200	1/150	1/100	1/60	1/60

Combined "Dysentery-Typhoid-Paratyphoid" Vaccine.

For the preparation of this combined vaccine broth cultures should never be used, as broth cultures of dysentery bacilli give rise to an extremely painful infiltration at the site of the inoculation.

Pepton water cultures should be used, or better, emulsions in salt solution, such as I use at the present time. The combined vaccine I now prepare consists of an emulsion of Shiga-Kruse, Hys Y bacillus, original Flexner bacillus, a Flexner-like bacillus No. 1 isolated in Ceylon, a Flexner-like bacillus No. 2 also isolated in Ceylon, typhoid bacillus, paratyphoid bacillus A. and paratyphoid bacillus B. The individual vaccines are prepared by making emulsions from twenty-four hours agar cultures, in normal salt solution (0·75 per cent.) to which 0·5 per cent. of carbolic acid has been added.

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The individual vaccines are standardized as follows per c.c. :—

Typhoid bacillus	4,000 millions.
Paratyphoid A bacillus	1,000 ,,
Paratyphoid B bacillus	1,000 ,,
Shiga-Kruse bacillus	1,000 ,,
Flexner bacillus	1,000 ,,
Hys Y bacillus	1,000 ,,
Flexner-like No. 1	1,000 ,,
Flexner-like No. 2.	1,000 ,,

These vaccines are mixed in equal parts so that one c.c. of the mixed vaccine will contain :—

Typhoid	200 millions.
Paratyphoid A	125 ,,
Paratyphoid B	125 ,,
Shiga-Kruse	125 ,,
Flexner	125 ,,
Hys Y	125 ,,
Flexner-like No. 1	125 ,,
Flexner-like No. 2	125 ,,

Of this vaccine 0·5 to 0·6 is given hypodermically the first time and 1 c.c. to 1·2 c.c. after a week. The reaction is somewhat more severe as a rule than after the typhoid-paratyphoid vaccine. As regards amount of protective substances induced by such vaccine very little can be said, as the agglutination for the germs of the dysentery group was generally slight, the agglutination limit seldom being higher than 1 in 40. It was also very irregular and inconstant, but the same may be said of individuals inoculated with simple Shiga-Kruse, Flexner, &c., vaccines. Typhoid, paratyphoid A and paratyphoid B agglutinins, on the other hand, are produced in fair amount, though, as a rule, distinctly less than in control individuals inoculated with simple typhoid, paratyphoid A and paratyphoid B vaccines. Possibly the amount of bacteria of each species inoculated falls below the necessary minimum.

"Cholera—Plague—Typhoid—Paratyphoid A—Paratyphoid B—Malta Fever" Vaccine.

This vaccine consists of an emulsion in carbolized ($\frac{1}{2}$ per cent.) salt solution (0·75 per cent.) of cholera vibrios, plague bacilli, typhoid, paratyphoid A and B bacilli and micrococcus melitensis. The individual vaccines are prepared as described in previous paragraphs and standardized as follows per c.c. :—

Cholera	4,000 millions.
Plague	1,000 ,,
Typhoid	1,000 ,,
Paratyphoid A	1,000 ,,
Paratyphoid B	1,000 ,,
Malta fever	4,000 ,,

These vaccines are mixed together in the following proportions :—

Cholera vaccine, two parts	2 c.c.
Plague ,, do.	2 c.c.
Typhoid ,, do.	2 c.c.
Paratyphoid A vaccine, one part	1 c.c.
Paratyphoid B ,, one ,, ...	1 c.c.
Malta fever ,, two parts	2 c.c.

Of this mixed vaccine 1 c.c. is inoculated the first time and 2 c.c. the second, a week later. This vaccine is still in the experimental stage having been used only in six individuals The reaction is somewhat severe and similar to that observed after inoculation of a simple plague vaccine or a combined plague-cholera vaccine. From some observations made it would seem that the production of agglutinins is very similar to that observed in individuals inoculated with one disease vaccines, but the investigation is still to be continued.

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Resumé and Conclusions.

I. The preparation of combined vaccines is based, I think I may venture to say, on the experimental work I carried out in 1901-1902 in Bonn, in Professor Kruse's Institute (Zeit. für Hygiene, 1902-1903), when I demonstrated that in inoculating an animal with two or three species of bacteria—provided a sufficient minimum quantity was given—agglutinins and immune bodies for all the germs were elaborated, the amount of agglutinins and immune bodies elaborated for each germ being nearly the same as in animals respectively inoculated with only one species.

II. I have prepared and used in man the following vaccines :—

(1) Typhoid—paratyphoid A—paratyphoid B.
(2) Typhoid—Malta fever.
(3) Typhoid—paratyphoid A—paratyphoid B—Malta fever.
(4) Typhoid—paratyphoid A—paratyphoid B—B. asiaticus—B. columbensis.
(5) Typhoid—paratyphoid A—paratyphoid B—B. asiaticus—B. columbensis—Malta fever.
(6) Typhoid—paratyphoid A—paratyphoid B—dysentery Kruse-Shiga—dysentery Flexner—dysentery Hys Y—dysentery Flexner-like No. 1—dysentery Flexner-like No. 2.
(7) Cholera—plague.
(8) Cholera—plague—typhoid—paratyphoid A—paratyphoid B.
(9) Cholera—plague—typhoid—paratyphoid A—paratyphoid B—Malta fever.

III. The inoculation in man of the above combined vaccines is harmless. The reaction is not severe, with the exception of those containing plague germs, such as the "cholera-plague" and "cholera-plague-typhoid-paratyphoid A-paratyphoid B" vaccines, when the reaction is severe, though apparently rather less so than after Haffkine's simple plague vaccine.

IV. The combined vaccines I am now using consist of carbolized emulsions of agar cultures in normal salt solution without heating. These emulsions seem to give a less painful local reaction than broth cultures killed by heat. The presence of 0·5 per cent. carbolic acid is sufficient to kill the germs. The "typhoid-paratyphoid A-paratyphoid B" vaccine is, however, also prepared by heating broth cultures at 53.

V. The individuals inoculated with the above-mentioned combined vaccines generally produce agglutinins for each species of bacteria, and the amount for each species is not much less than control individuals inoculated with simple "one disease" vaccines. The only exception—though only to a certain extent—seems to have been in the case of typhoid-dysentery vaccines.

VI. Combined vaccines, when efficient, are of practical advantage, saving a great deal of time, and rendering possible a contemporaneous vaccination for several different maladies.

The Hyphomycetes found in Sprue.

In the present report I do not propose to discuss the etiological rôle played by fungi in sprue, but merely to study the subject from a botanical point of view.

Historical.—Kohlbrugge in 1901 (see *Arch. f. Schiffs u. Tropen-Hygiene*, 1901, *No.* 12) found in cases of sprue a fungus which he identified with the thrush fungus (*Monilia, Oidium, Endomyces, Saccharomyces albicans*). He made a very complete histological study of one of his cases which ended fatally, and emphasized the fact that the fungus in sections of the tongue, &c., had invaded the deep strata of the mucosa, the glands, and portions of the submucosa. He concluded that the thrush fungus, or *Monilia albicans*, was the cause of the disease. Kohlbrugge's findings were confirmed by many observers : Le Dantec suggesting for the disease the term "*Blastomycosis intestinalis.*"

From 1909, being interested in the subject of fungi in general, I have studied the hyphomycetic intestinal flora of a certain number of typical cases of sprue, as well as of other conditions, and normal individuals, and have come to the conclusion

that there are several different species of intestinal monilias (*M. intestinalis*, *M. fæcalis*, &c.) In my paper on sprue in the *Rivista Critica Clinica Medica*, 1912, I discussed all the various theories, bringing forward what had been found in favour of each by myself and others: I did not express any opinion as regards the etiological rôle of these fungi in sprue, except that they were probably the cause of the frothy diarrhœa. Having noted that this frothy diarrhœa generally improves after strong doses of bicarbonate of soda, I thought that sodium bicarbonate given in large doses, by decreasing the acidity of the intestinal contents might check the growth of fungi, which, as is well known, grow better on acid than on alkaline media.

In 1913 Dr. George Low and myself described a new species of monilia we found in a case of sprue, and called it *Monilia decolorans*. We considered this monilia and similar ones to be probably the cause of some of the important symptoms of the disease, such as frothiness of the stools, &c., but we were not inclined to consider them to be the primary cause of the malady; we quoted in analogy the example of scabies, in which the main part of the symptoms is due to the secondary invasion by staphylococci and not the primary or real cause, the acarus. We quoted also the example of pulmonary tuberculosis, in which a very important symptom, the serotine fever, is not due to the tubercular bacillus, but to the secondary treptococcal infection.

Recently (April, 1914) Dr. P. Bahr has published a report of his investigation of the malady in which he identifies the fungi found in sprue with the thrush fungus (*Monilia albicans*) completely supporting Kolbrugge· He seems also to be inclined to agree with Kolbrugge that *Monilia albicans* is the primary cause of the disease.

Presence of fungi in sprue.—In practically every case of sprue it is easy to put in evidence hyphomycetes in the stools, and scrapings from the tongue. The microscopical examination of the frothy motions will often reveal the presence of spore-like bodies and mycelial elements typical of the genus monilia. Even when fungi are not observed microscopically they can generally be put in evidence by cultures, inoculating glucose agar or glucose broth tubes with a particle of the stools. Though generally in much less amount, it is not rare in the tropics to find microscopically identical fungi in stools of patients suffering from other diseases (dysentery, enteric, etc.), and occasionally in normal persons. Microscopically identical fungi may be isolated also from the air, tea dust, copra dust, etc., etc.

Botanical position of the fungi found in sprue. Differentiation of intestinal monilias and monilias in general.—As already stated, all monilias found in sprue as well as in other conditions, such as bronchomycosis, thrush, otomycosis; those found in the air, tea dust, copra dust, etc., have all been considered to be the same species, and identified with the thrush fungus or *Monilia albicans*. Since 1909, in a series of papers I have expressed the opinion based on a certain number of experiments, that the term "thrush fungus" or *Monilia albicans* (*Odium*, *Saccharomyces*, *Endomyces albicans*) has been used to cover a large number of different species (possibly even different genera) of fungi, in the same manner that, till some years ago, the term *B. coli* was used to indicate a prodigious number of different bacteria, in the same manner that the term *Trychopython tonsurans* till fairly recently covered numerous different fungi, belonging not only to different species but to different genera, such as the genera epidermophyton, microsporon, endodermophyton. This, in my opinion, erroneous conception of *Monilia albicans* has been due to the classification of such fungi being based hitherto solely on their morphological and microscopical characters and gross appearances of cultures on solid media. Since 1908 I have suggested the classification of such fungi should be based, not only on their morphological appearances, but also, and principally, on (1) their action on litmus milk and gelatine; (2) their action on carbohydrates; (3) on agglutination and immunisation phenomena, whenever possible.

Action of fungi of the genus monilia on litmus milk and gelatine. Some monilias coagulate milk, others do not; some monilias render it acid without coagulating it; some strains decolorize the medium. The greatest number of strains in my experience do not liquefy gelatine, while a few, including the original *Monilia albicans, sensu stricto,* do liquefy this medium.

Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

Action of monilias on carbohydrates.—I have always used a very large number of sugars, but for practical purposes the following are sufficient for the identification of most species: glucose, saccharose, lævulose, galactose, maltose, mannite, lactose. I have observed, in analogy to what takes place when dealing with bacteria, that certain well defined species (for instance, *Monilia intestinalis*, *Monilia tropica*) do not change to any appreciable extent their fermentation properties in the course of time; while with other species the fermentation properties are not constant. I have noted also that strains which do not ferment certain sugars may be trained at times to do so, but this is the case also with many bacteria. It is well known, for instance, that Penfold has been able to change the fermentative properties of germs of the typhoid colon group to a remarkable degree: still no one denies the validity of the usual fermentation tests in differentiating between organisms of this group.

As regards the use of immunization, agglutination, and complement fixation phenomena for the differentiation of monilias, unfortunately these are experiments which take a very great deal of time. I may say, however, that rabbits inoculated subcutaneously with repeated small doses of cultures of monilias, often develop agglutinins in their blood, and these are to a certain extent specific, *viz.*, the inoculated rabbit develops a distinct amount of agglutinins only for the species with which it has been inoculated. It would seem from the experiments made—which however, I consider far from being complete—that the classification data obtained in this way are, broadly, in consonance with the results and data obtained by the action of the organisms on milk, gelatine, and sugar broths.

Description of certain species of monilias found in cases of sprue.

In previous reports I have given a description of numerous species of the genus monilia as found in stools, sputum, in tea dust, in copra dust, etc., etc. It is quite possible that future investigation may show that some of the species created cannot stand, but I venture to say that my main point, *viz.*, that there is a plurality of species of the so-called *Monilia albicans*, or thrush-fungus, will be confirmed.

I will limit myself to give here a description of monilias found in stools, and only those species which I consider to be *good.* Some of these species have already been published, but I will repeat here their description for the reader's convenience.

For those who may be interested in the comparative study of these fungi I annex a table containing species derived from cases of bronchomycosis, thrush, tea dust, etc.

Table XV.

Intestinal Monilias.

—	Litmus Milk.	Glucose.	Lævulose.	Maltose.	Galactose.	Saccharose.	Lactose.	Mannite.	Dulcite.	Dextrin.	Raffinose.	Arabinose.	Adonite.	Inulin.	Sorbite.	Broth.	Peptone Water.	Indol.	Gram.	Gelatine.	Serum.	Neutral Red.	Inosite.	Salicin.	Amygdalin.	Isodulcite.	Glycerin.	Erythrite.
Monilia asteroides, Cast., 1914	A C	A	A	A	A	A	A	A	O	A	A	O	O	O	A	T	C	—	+	—	O	—	—	—	—	—	—	—
Monilia fæcalis, Cast., 1911	A / D Ps	A G	A G	A G	A Gs	A Gs	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O B	O	—	—	—	—	—	—
Monilia insolita, Cast., 1911	As / Alk	A G	A G	A G	A G	A G	O	As	O	O	O	O	O	O	O	C	C	O	+	O	O B	O	—	—	—	—	—	—
Monilia intestinalis, Cast., 1911	A Ds	A G	A G	As	A	A	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia rotundata, Cast., 1911	A C	A	A	A	A	O	A	O	O	O	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia decolorans, Cast. and Low, 1913	D F C	A Gs	A G	A Gs	A	A	O	O	O	A	O	O	O	O	O	C	C	O	+	O	O	O	O	O / Alk	O	O	A	O

A—acid; G—gas; C—clot (milk); clear (broth and peptone water); D—decolourized; P—peptonized (milk); $\frac{A}{Alk.}$—acid then alkaline; S—slight; +—positive result; F—fine; O—negative result, viz.: neither acid nor gas in sugar media, non-production of indol, non-liquefaction of serum or gelatine, as the case may be.

TABLE XVI.

TABLE SHOWING MONILIAS SO FAR FOUND IN MAN, WITH NAMES IN ALPHABETICAL ORDER.

—	Litmus Milk.	Glucose.	Lævulose.	Maltose.	Galactose.	Saccharose.	Lactose.	Mannite.	Dulcite.	Dextrin.	Raffinose.	Arabinose.	Adonite.	Inulin.	Sorbite.	Broth.	Peptone Water.	Indol.	Gram.	Gelatine.	Serum.	Neutral Red.	Inosite.	Salicin.	Amygdalin.	Isodulcite.	Glycerin.	Erythrite.
Monilia albicans, Robin.	A C	A G	A Gs	A Gs	A G	Avs	O	O	O	O	O	O	O	O	O	CTP	C	O	+	+	+s	O	—	—	—	—	—	—
Monilia asteroides	A C	A	A	A	A	A	A	A	O	A	A	O	O	O	A	T	C	—	+	—	O	—	—	—	—	—	—	—
Monilia blanchardi, Cast.	Avs / Alk	A Gs	A	A	A	A	O	O	O	O	As	O	O	Avs	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia bronchialis, Cast.	O	A G	A G	A G	O	A Gs	O	O	O	A	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia burgessi, Cast.	O / Alk	A Gs	A	A Gs	A	A Gs	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O B	O	—	—	—	—	—	—
Monilia chalmersi, Cast.	As / Alk	A G	A G	As	A Gs	A G	O	O	O	O	As	O	O	A Gs	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia decolorans, Cast. and Low ...	D F C	A Gs	A G	A Gs	A	A	O	O	O	A	O	O	O	O	O	C	C	O	+	O	O	O	O	O / Alk	O	O	A	O
Monilia enterica, Cast....	O / Alk	A G	A G	A G	A G	A G	O	As	O	As	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia fæcalis, Cast.	A / D Ps	A G	A G	A G	A Gs	A Gs	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O B	O	—	—	—	—	—	—
Monilia guillermondi, Cast.	O / Alk	A G	A G	As	A	A G	O	O	O	O	A Gs	O	O	O	O	CTP	C	O	+	O	O	O	—	—	—	—	—	—
Monilia insolita, Cast.	As / Alk	A G	A G	A G	A G	A G	O	As	O	O	O	O	O	O	O	C	C	O	+	O	O B	O	—	—	—	—	—	—
Monilia intestinalis, Cast.	A Ds	A G	A G	As	A	A	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia krusei, Cast.	O	A G	A G	O	O	O	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia lustigi, Cast.	As / D	A	A Gs	Avs	A	A Gs	O	O	O	A	A Gs	O	O	O	O	C	C	O	+	O	O B	O	—	—	—	—	—	—

—	Litmus Milk.	Glucose.	Lævulose.	Maltose.	Galactose.	Saccharose.	Lac ose.	Mannite.	Dulcite.	Dextrin.	Raffinose.	Arabinose.	Adonite.	Inulin.	Sorbite.	Broth,	Peptone Water.	Indol.	Gram.	Gelatine.	Serum.	Neutral Red.	Inosite.	Salicin.	Amygdalin.	Isodulcite.	Glycerin.	Erythrite.
Monilia negrii, Cast.	Avs / Alk	A G	A G	As	A Gs	A G	O	O	O	O	A Gs	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia nivea, Cast.	O / Alk	A G	A G	A G	A G	A Gs	O	O	O	O	A G	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia nitioa, Cast.	A / D C	A G	A G	A	A	A	A	A	O	Avs	As or O	O	O	O	O	CTP	C	O	+	O	O	O	—	—	—	—	—	—
Monilia paratropicalis, Cast.	As / Alk	A G	A G	A G	A G	A G	O	O	O	Avs	O	O	O	O	O	CTP	C	O	+	O	O	O	—	—	—	—	—	—
Monilia perryi, Cast.	As / D Alk	A	A Gs	A	A	A Gs	O	O	O	O	As	O	O	Avs	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia pinoyi, Cast	O	A G	A G	A G	O	O	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia pseudo tropicalis, Cast. ...	A Cs	A G	A G	O	A Gs	A G	A G	O	O	O	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilie pulmonalis, Cast.	O / Alk D	A G	A G	A G	A Gs	A G	O	Avs	O	O	A	A Gs	O	O	O	CTP	C	O	+	O	O B	O	—	—	—	—	—	—
Monilia rhoi, Cast.	As / Alk	A G	A G	Avs	A Gs	A G	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia rotundata, Cast.	A C	A	A	A	A	O	A	O	O	O	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia rugosa, Cast.	A / Ps Cs	As	As	As	As	As	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O	O	—	—	—	—	—	—
Monilia tropicalis, Cast.	A or O	A G	A G	A G	A Gs	A Gs	O	O	O	O	O	O	O	O	O	C	C	O	+	O	O B	O	—	—	—	—	—	—
Monilia zeylanica, Cast.	A C S	A	A	A	A	A	As	O	O	A	Avs / Gvs	O	O	Avs	O	C	C	O	+	O	O	O	—	—	—	—	—	—

ABBREVIATIONS USED IN THE TABLES :—

A—acid; G—gas; C—clot (milk) clear (broth and peptone water); C.T.P. clear at first then thin, pellicle present; D—decolourized; P—peptonized (milk); Pellicle (broth) Alk—alkaline; $\frac{A}{Alk.}$—acid, then alkaline; S—slight; VS—very slight; B—brown pigmentation of the medium; O—negative result, *viz.*, neither acid nor clot in milk; neither acid nor gas in sugar media, non-production of indol; non-liquefaction of gelatine or serum as the case may be; +—positive result, liquefaction of medium; F—fine.

Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

Monilia intestinalis, Cast., 1911.—Microscopically has all the characters of the genus monilia; grows abundantly on slightly acid sugar media, giving rise to large white colonies, which soon coalesce into a cream-like abundant growth. The growth is composed practically of only globular yeast-like cells, while in the water of condensation globular cells and mycelium may be found together.

A little mycelium may be found, however, also in the growth on the slope. Ascus formations are absent, gelatine and serum are not liquefied, litmus milk is slowly decolourized, the decolourization starting at the bottom of the tube. No clotting. This monilia produces acid and gas in glucose and lævulose, acid in maltose, galactose, saccharose; does not ferment lactose, mannite, dulcite, dextrin, raffinose, arabinose, adonite, inulin, sorbite.

Origin.—Isolated by me in three cases of sprue.

Monilia fœcalis, Cast., 1911.—Grows abundantly on sugar media, giving rise to white colonies, which soon coalesce. Milk is rendered first slightly acid, then alkaline, gelatine not liquefied. Serum is not liquefied: a dark pigmentation often develops on the surface of the medium round the growth—this pigmentation may be lost in sub-cultures.

Origin.—Isolated from two cases of sprue, one of enteritis, one of ptomaine poisoning; also from a sputum which has been collected in a dirty receptacle.

Monilia insolita, Cast., 1911.—Colonies on sugar media, white. Milk is first very slightly acid, then alkaline, and becomes slowly decolourized. Gelatine is not liquefied. The growth on serum does not become surrounded by a zone of dark pigmentation; the medium is not liquefied. The fungus produces acid and gas in glucose, lævulose, maltose, galactose, saccharose, produces often slight acidity in mannite, and does not ferment lactose, dulcite, dextrin, raffinose, arabinose, adonite, inulin, sorbite.

Origin.—This monilia was isolated from the stools, saliva, and scrapings of tongue from a case of sprue; stools of two cases of enteric, and a normal individual; also from sputum.

Remarks.—It is probable that this monilia is in reality merely a variety of *M. fœcalis.*

Monilia tropicalis, Cast., 1900.—On glucose agar large white colonies appear which later on coalesce. Gelatine and serum not liquefied; there is no brownish or black discolouration of the serum. Litmus milk is not changed, or is rendered slightly acid: it is never clotted. This monilia produces acid and gas in glucose, lævulose, maltose, galactose, and saccharose; does not ferment lactose, mannite, dulcite, dextrin, raffinose, arabinose, adonite, inulin, sorbite.

Origin and remarks.—Found once in the stools of a case of sprue. This species is the most frequently met with in Ceylon, in cases of broncho-mycosis.

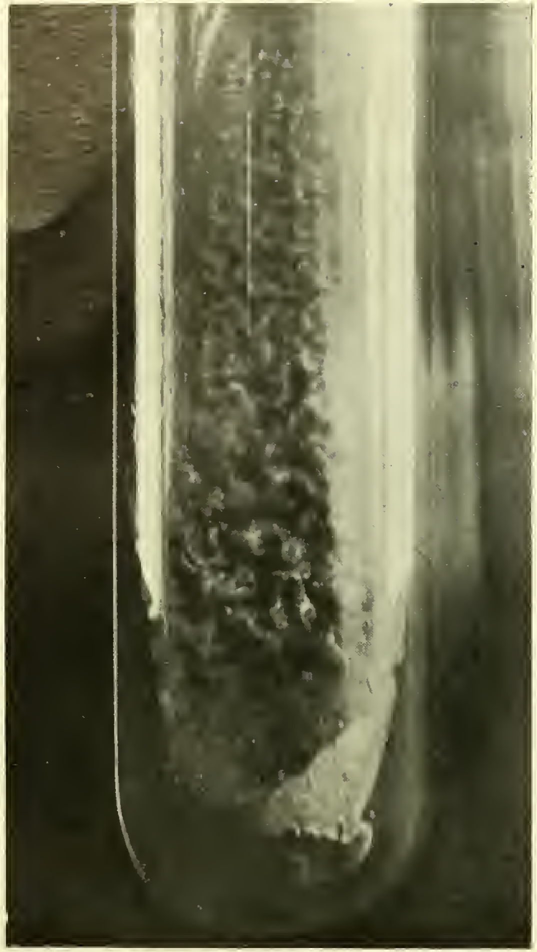
Monilia (?) *rotundata*, Cast., 1911.—Growth on glucose agar has a somewhat crinkled appearance. The colour is yellowish. Milk is rendered strongly acid and clotted. Serum and gelatine are not liquefied. This fungus does not produce gas in any sugar (glucose, lævulose, galactose, saccharose, lactose, mannite, dulcite, dextrin, raffinose, arabinose, adonite, inulin, sorbite); it produces acidity in glucose, lævulose, maltose, galactose, lactose.

Origin.—Isolated by me from stools of a case of sprue, a case of enteric, and a case of simple enteritis.

Monilia decolorans, Cast. and Low, 1913.—Has all the characters of *Monilia intestinalis*, Cast., apart from the fact that after a time it coagulates milk.

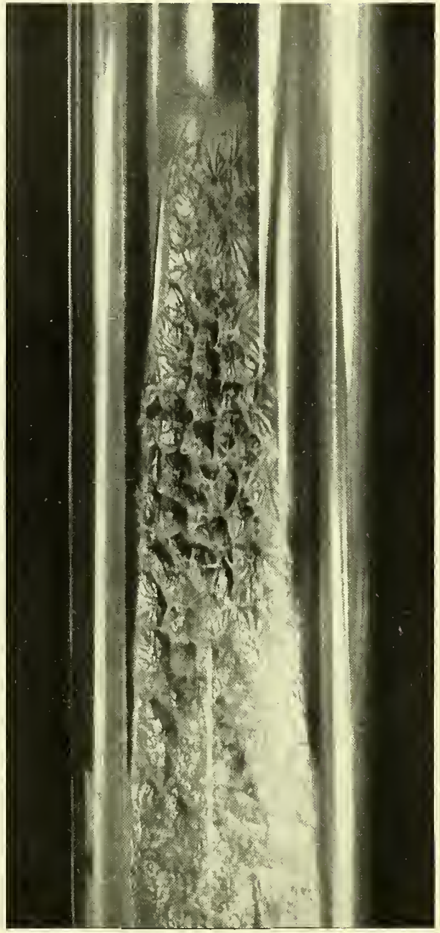
Monilia asteroides, Cast., 1914.—The colonies on glucose agar have a characteristic, radiating appearance (see photograph), hence its name. This fungus does not clot milk, grows very badly or not at all on serum, which is never liquefied. Does not produce gas in any of the sugars used, but produces acidity in lævulose, saccharose, glucose, maltose, mannite, galactose, lactose, raffinose, dextrin, sorbite.

Origin.—This fungus has been isolated from the stools of a case of sprue, also from one of those peculiar cases of pseudo-sprue I have described, which seem to be in reality chronic infections due to a Flexner-like bacillus.



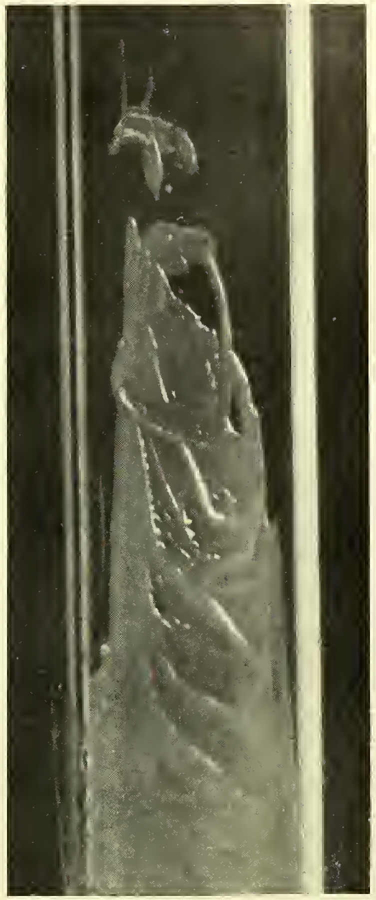
M. Jos. de Silva Colombo

Monilia rotundata.



M. Jos. de Silva Colombo

Monilia asteroides.



M. Jos. de Silva Colombo

Monilia intestinalis.

Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

Remarks.—It is doubtful whether it is botanically correct to place this species and *Monilia rotundata* in the genus monilia. They possibly belong to different genera, but further researches are necessary on this point.

Conclusions.

I.—In practically every case of sprue it is possible to put in evidence fungi: microscopically or culturally.

II.—These fungi do not all belong to the same species—the so-called "thrush fungus" or *Monilia albicans*, as stated by Kohlbrugge and all other observers who have confirmed his findings.

III.—As I have stated since several years, there is a plurality of species of such fungi, and the term *Monilia albicans* has been used in the past to cover a large number of different species and possibly different genera, in the same manner as in the past the term *B. coli* was used to cover a great number of different bacteria.

As a matter of fact, *Monilia albicans sensu stricto* (*M. albicans*, Robin, 1853, em. Cast, 1909, has never been observed by me in sprue cases, as none of the monilias isolated by me in sprue liquefies gelatine.

IV.—The following, probably good species, have been isolated from the stools or scrapings of tongue and saliva of sprue patients: *Monilia intestinalis*, Cast., 1911, *Monilia decolorans*, Cast. and Low, 1913, *Monilia fœcalis*, Cast., 1911, *Monilia tropicalis*, Cast., 1911, *Monilia asteroides*, Cast., 1914. The same patient may occasionally harbour two or more different species.

Monilia intestinalis and *Monilia decolorans* have so far been found only in sprue cases; the other species have been found in several other conditions besides sprue.

Aldo Castellani.

No. 6.

JAMAICA.

The GOVERNOR to the SECRETARY OF STATE.

(Received 9th May, 1914.)

Sir, King's House, Jamaica, 20th April, 1914.

In continuation of my despatch of the 16th October last,* I have the honour to transmit, for the information of the Committee of the Tropical Diseases Research Fund, the report of the Government Bacteriologist of this Colony on the work carried out by him and his assistant for the half-year, from 1st October, 1913, to the 31st March, 1914.

I have, &c.,
W. H. MANNING,
Governor.

Enclosure in No. 6.

Six-Monthly Report on the Work done at the Pathological Laboratory, September, 1913—March, 1914.

Pathological Laboratory, Public Hospital, Kingston, Jamaica,
31st March, 1914.

Sir,

I have the honour to forward my report, for the information of the Right Honourable the Secretary of State for the Colonies and of the Tropical Research Committee, upon the work done at the Pathological Laboratory during the period September, 1913—March, 1914.

In November last Dr. Catto, M.B., B.S. (London), who had been selected for the post of Assistant Bacteriologist, arrived in Jamaica, and I feel sure that with his help good work will be able to be carried out in the domain of research into various diseases prevalent in this island.

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* Page 189 of [Cd. 7261].

Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

As will be seen from the table (Table V.) appended, the previous large number of specimens received for examination is being maintained, namely, 3,271 for the six months, making a total for the year of 6,521.

For the purposes of description I propose to tabulate these into the two main groups:—1, Routine work; 2, Special matters, including research, and to sub-divide these as follows:—

I. Routine Work:—
1. Enteric fever.
2. Blood examinations for malaria, babesia, filaria, etc.
3. Fæcal examinations.
   (*a*) For helminthiasis.
   (*b*) For amœba, *B. typhosus*, etc.
4. Urine examinations.
5. Pus specimens.
6. Sputa.
7. Tissues sectioned for diagnosis, etc.
8. Waters subjected to bacterial analysis.
9. Miscellaneous; including effusions, gastric contents, vaccines, etc.

II. Special matters:—
1. Pellagra.
2. Streptothrix.
3. Vomiting sickness.

To dispose of the routine work first:

1. *Enteric fever.* During the six months under review 474 specimens of blood have been examined by Widal's agglutination reaction. This number is less than that of the previous six months, but still bears out the point on which I have more than once laid stress already, namely, that a large proportion of positive reactions (considerably larger than appears to be the case in other countries) occur with *B. paratyphosus A*. Many instances of the "eight-ten day fever" in Jamaica are, I am convinced, due to organisms of the coli-typhoid group, and, though not due definitely to *Paratyphosus A* in every case, some instances are to be so ascribed, as evidenced by the high degrees of dilution of the serum in which a positive reaction occurs. In other cases agglutination occurs in low dilutions, such as 1 : 30, fairly frequently, and with 1 : 50 not uncommonly. Since a similar result is obtained also with *B. typhosus* in the former dilution, the organism, one would infer, is a member of this group, and, consequently, gives rise to a "group agglutination" reaction in the serum of the patient affected. I think that one might even venture a stage further and say that, since the agglutinins for *B. paratyphosus* are marked in higher dilutions than those for *B. typhosus*, the organism is probably more nearly related to the former than the latter in these shorter fevers.

The fact that the ratio of positive paratyphosus reactions is this time in excess of that given in my last report must not be taken as implying that this disease is on the increase; the explanation is that many more specimens are sent up from doubtful cases now than was formerly the case. For example, a patient has a moderately severe attack of fever which does not yield to quinine, but the constitutional symptoms do not appear to the medical attendant to be so marked as in a true case of typhoid. Formerly "expectant treatment" would have been persisted in, and when the fever disappeared at the tenth day or so the happy result would be attributed to the line of treatment adopted, and the doctor would congratulate himself on having had the courage of his convictions, and in having persisted in the administration of quinine, or antipyretics, and the patient would go away with the idea that his form of malaria was a very obstinate one, and that quinine would not act in his case for ten days. Or he would take up the position that "quinine was unsuitable for his form of malaria," but that it yielded at last to Tinct. Iodi in small doses, or Sodii Bicarb., or whatever placebo may have been given to him, or to panopepton, sanatogen, or any other nostrum which his fancy may have led him to make trial of. The evil effects of such a point of view, however, would be more widespread than this; for, in the event of the patient later suffering from a true attack of malaria, valuable time would be lost owing to the attitude of the patient or his friends that he "could not take quinine," or that "it did not suit his particular form of malaria."

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On the other hand, in many cases of severe or typical average cases of typhoid fever (except in hospital) no specimen is sent up, the case being reported as enteric fever without any bacterial examination being made.

Now, however, matters are different, for knowledge of the uses of a clinical laboratory is not confined to medical men, and the patients themselves urge the attendant to send up to "make sure" that what the latter regards as malaria is really such and not typhoid in anomalous form.

Hence I believe the increase of positive paratyphosus reactions is to be ascribed not to the greater prevalence of this disease, but to the larger number of specimens sent up from patients exhibiting an ill-defined course of temperature lasting for over a week. Repeatedly I have had letters from practitioners here within a day or two of my reporting to them a positive agglutination of *B. paratyphosus*, saying that the blood had been taken on the seventh or eighth day, and that within forty-eight hours the temperature had fallen to normal.

I need not dilate upon this question, for I spoke of it in detail in a former report upon 1,500 consecutive Widal reactions, and my remarks there were afterwards extended and amplified into a paper which was printed in the *Practitioner* medical journal, of October, 1913, where all these various points were dealt with.

Of the 474 specimens examined, 111, or 23·4 per cent., gave a positive reaction with *B. typhosus* only, 94, or 17·72 per cent., with *B. paratyphosus* only, while 35, or 7·38 per cent., were cases of mixed infection.

Also, of the 240 cases which gave a positive reaction, 111, as above, or 46·25 per cent., did so with *B. typhosus* only, 94, or 39·16 per cent. with *B. paratyphosus* only, and 35, or 14·58 per cent., were of double infection.

Tables I. and II., appended, show the results of these examinations month by month, and the various districts from which specimens have been sent.

2. *Blood Examinations.*—There is very little to say on this point. They have almost entirely consisted of smears sent up for diagnosis of malaria, or for differential leucocyte enumerations.

Of the malaria smears, by far the majority of those showing parasites contain *Plasmodium præcox.* Quartan parasites and benign tertian were both rare, amounting to about 10 per cent. only in each case, the remaining 80 per cent. being subtertian. In two instances all three were present, and in three others the *P. malariæ* and *falciparum* were combined.

A few smears were sent up for examination for the *Piroplasma bigeminum*, and this protozoon was found in about half the slides. Trypan blue was used with successful results in nearly all cases, but in some of them parasites persisted, possibly because too small a dose had been given at first. When this is the case it is often found that the organism appears to have become to some extent "trypan fast," and large subsequent doses are ineffectual in ridding the animal of the infection; in a few, again, the preliminary dose apparently brings about the condition of hypersensitiveness, and the second dose results in the production of anaphylactic symptoms, which have in some terminated fatally.

The blood has also been examined from several pellagra patients, but this question is dealt with later (p. 4).

From one case blood smears were sent up which showed *Filaria diurna* on examination. As I have not yet found any cases of this affection in a Jamaican (unless he had been abroad to other West Indian islands), I made inquiries, and discovered that the patient was a student at the training college for teachers here, and had been sent over from British Guiana. The record, therefore, still remains unbroken, and I do not think that the condition exists, at least to any extent, in Jamaicans who have always resided here.

3. *Examination of Fæces for Helminthiasis.*—During the last six months 1,338 specimens have been examined for the presence of ova of ankylostome and other parasites, as compared with 1,162 during the preceding period.

Taking account of the results over the whole island, there is not as yet indication of much improvement. One could hardly expect any after only six months' treatment of a condition so very widespread. At the same time it must be noted that the difference, though slight, is on the right side; in other words, although more specimens have been sent up to the laboratory, the percentage number found

infected is about 8·5 per cent. less as regards total helminthiasis, of which a little over half is due to reduction of ankylostomiasis alone and in combination.

The reduction in the percentage of those containing ankylostome alone amounts to but 1·5, showing that, though other parasitic worms may be got rid of with comparative ease, the hookworm eradication is a more difficult matter.

The results of treatment show considerable variation when one analyses the findings in specimens sent from various districts. To take one example: The District Medical Officer at Lionel Town has evidently been going in very thoroughly for adequate treatment of those under his charge, for of the specimens sent up during the six months, March to September, 1913, which amounted to 140 in all, over 87 per cent. showed helminthiasis in some form or another, and 66 per cent. of these (58·5 per cent. of the whole) contained hookworm ova. During this last six months, however, more than double the number of specimens have come from that district (309), but positive results were found only in 63·75 per cent., and 40·4 per cent. contained ankylostome ova.

Comparison between the results set forth in my last report and those of the present cannot be carried much further than has just been indicated without tending to lead to erroneous conclusions; for the specimens sent up last year were almost entirely taken haphazard from persons who had not been under treatment for this condition, and so formed a fair estimate of the prevalence of helminthiasis in Jamaica.

During the last six months, however, specimens have been sent up repeatedly from the same patients, in order to see whether they were still harbouring the parasites, or in other words to test the effects of the treatment.

One conclusion may safely be drawn from these figures, and that is that the eradication of the pest is not proving the comparatively simple undertaking which many imagine it to be. To find the ova in the fæces, and, in consequence, to order the dispenser to prepare a dose of thymol, is nothing less than playing with a disease which causes untold misery and inestimable incapacitation among labourers on the various plantations.

The results given also tend still more to drive home the lesson that, however adequately the individual members are dosed with thymol, recurrence must take place so long as the soil remains infected, and that, even if the soil were once rendered free from the larvæ, infection of it must inevitably occur so long as untreated coolies are brought to this country and sent up to the districts to spread the condition broadcast.

Ankylostomiasis will never be stamped out on the coolie estates unless:

1. Immigrating coolies are treated on the voyage, so that they land here free from infection; or, if this for some reason or other is not found practicable,
2. They are kept at a base depôt until repeated examination shows them to be free from the parasite before they are sent up country:
3. Adequate latrine accommodation is provided on the estates:
4. Care be taken that such latrines are used.

Lastly, my examinations show again that thymol is not an efficient anthelminthic for trichuris. Fæces which had shown trichuris as well as ankylostome to be present, and which had been sent up repeatedly from the same patient in order that it might be known whether the latter had been expelled as a result of thymol, proved abundantly the fact that, while the latter became less and less, even to complete disappearance, the former showed very little diminution. Clinically, therefore, one is led to expect what the figures themselves show that, whereas in my last report 8·48 per cent. of positive results contained trichocephalus only, and this time 8·07 per cent. come under the same heading; if we include those containing trichocephalus in combination, 49·46 per cent. did so in my previous report, as compared with 48·61 per cent. in the present one; thus, there is seen to be no appreciable difference.

Ascaris infection also is very common here. Not infrequently one sees 20, 30, and even 50 ova in a single field. This apparently is not regarded as of any importance, in spite of the fact that a large proportion of deaths (in vomiting sickness, for example) is ascribed to it.

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Taking the figures in my September report, in 4·76 per cent. of cases of helminthiasis ascarides were present alone, and in 36·77 per cent. counting those which showed them to be present in combination with others, while in this review, although ankylostome shows, as already stated, slight reduction owing to its treatment being assiduously undertaken, ascariasis has increased; for this parasite was found in 42·37 per cent. of cases.

Other worms which have been found, but rarely, were *Strongyloides intestinalis*, *Oxyuris vermicularis*, and on two occasions ova of *Tænia diminuta* (both from Lionel Town).

Apart from fæces sent up as above, 91 specimens have been examined for *Amœba dysenteriæ*, *B. typhosus*, *B. dysenteriæ*, etc. The former have been found on twenty-four occasions.

4. *Other Routine Examinations.*—Specimens of urine, pus, sputa, water for bacterial analysis, and other routine matters do not call for special mention; the appended table shows how many of them have been dealt with.

II.—Special Matters.

1. Pellagra.
2. Streptothrix Infection.
3. Vomiting Sickness.

1. *Pellagra.*—Dr. Catto and myself are undertaking an investigation into the morbid anatomy of pellagra. There are a considerable number of these cases at the asylum in Kingston, but I regret to say that it is a very difficult matter to obtain reliable histories of such patients. In many of them it is impossible to say, for example, whether their mental condition is an outcome of the pellagra, or whether one is dealing with pellagra supervening in an insane subject. The investigation is only in its inception. We have commenced by taking specimens of blood at various stages of the disease, and from extensive differential leucocyte enumerations fail to find any alteration common to them. 500 leucocytes are counted in each case. No useful purpose would be served by giving the details of each one, but the minimum, the maximum, and the average of each variety of cell will be stated, thus showing the variations which may occur.

—	Polymorph.		Large Mono-nuclear.	Transitional.	Lymphocytes.			Eosinophile.	Basophiles.	Myelocytes.
	Normal.	Stab-Kernige.			Large.	Small.	Türks.			
Average ...	49·8	2·6	3·5	1·7	7	24·1	1·2	9·5	0·5	0·1
	52·4		5·2		32·3			9·5	0·5	0·1
Maximum ...	73	3·8	7·4	2·6	12	31·8	3	19·6	1·2	1·0
	76·8		10·0		46·8			19·6	1·2	1·0
Minimum ...	31·4	1·0	1·9	1·0	1·8	8·6	0	0·6	0	0
	32·4		2·9		10·4			0·6	0	0

It is thus seen that the variations may be very wide, but the average agrees, except in one particular, fairly closely with what has been found elsewhere, as, for instance, by the Illinois Pellagra Commission, which gives as an average: polymorphonuclears 57·22, large mononuclears and transitionals 3·42, lymphocytes 34·22, eosinophiles 4·5, basophiles 0·67 per cent., as compared with our figures of 52·4 5·2, 32·3, 9·5, and 0·5 respectively.

The striking difference occurs in the high degree of eosinophilia in our cases, and that is explained by the enormous prevalence of helminthiasis in this island, a matter of which I have already treated in this report. It is of importance to bear in mind the fact that in the insane there are possibilities of so many conditions which will tend to upset the normal proportions of the different leucocytes to one another; as, for instance, the presence of intestinal parasites, small wounds, intercurrent diseases and so forth. But, when comparing the counts from subjects in about the same stages of the disease and of a similar degree of severity,

we have been driven to the conclusion that there are no characteristic variations of sufficient constancy to warrant any serviceable inferences.

The classification adopted as the one least liable to error from the personal equation has been that of von Schilling Torgau; namely:—

1. Neutrophile (finely granular oxyphile) with the usual polymorph-nucleus.
2. The "Stabkernige" form of the above with nucleus T., U., or V-shaped, not properly polymorphonuclear.
3. Lymphocytes, divided into small and large. It is here that the personal element might come in, but as far as possible by "large" we imply mononuclear cells about 12μ in diameter, with a round or oval nucleus more or less centrally situated.
4. Türk's "Reizungsformen" lymphocytes.
5. Large mononuclear cells of about 14-20μ with eccentrically situated nucleus, staining more faintly than that of the large lymphocyte and with abundant pale blue staining protoplasm.
6. Transitionals; somewhat similar cells, but with a nucleus tending to become folded and polymorph.
7. Eosinophile.
8. Basophile or mast cells.

No mention has been made of the erythrocytes because, though carefully examined, no changes were as a rule found in them. Occasionally we came across a nucleated one, and in some few instances there was a little polychromatism and anisocytosis, but not sufficient or frequent enough to call for special remark.

2. *Streptothrix.*—In two cases exhibiting the symptoms of tuberculosis of the lung from whom a specimen of the sputum was sent up for examination for the *Bacillus tuberculosis*, I was unable to detect any of these organisms, but saw under the microscope some filaments of a streptothrix.

The patients showed local physical signs in the upper lobe of the left lung in one case, in the middle lobe of the right in the other, and clinical symptoms of cough with evening rise of temperature. Repeated examinations failed to reveal any tubercle bacilli, but each time pieces or small masses of thin, branching mycelium were seen. These, on staining by Gram's method, stained a little irregularly, giving somewhat of a granular appearance; the threads were not acid-fast, though here and there in the length of a thread appeared a small fragment which retained the stain.

I obtained a growth in liquid medium—peptone broth—but growth was slow. In this it appeared as small dots at the sides of the culture tubes, while a deposit consisting partly of similar mycelium was seen at the bottom.

Growth in the broth was obscured by the more rapid development of bacteria. I tried plating on various solid media in order to isolate the organism, but did not succeed. I was able, however, to carry it on through three broth cultures in one case and four in the other, but no further.

In default of isolation animal experiments were not carried out.

I notice that in the Milroy Lectures for 1910 Mr. Foulerton says:—"Of all the ordinary culture media peptone broth seems the best suited for the growth of these parasites; growth appears between the third and seventh days of incubation at a temperature of 37°C., and is represented either by a filmy-looking mass of very small white colonies at the bottom of the broth or by small isolated colonies which adhere to the side of the tube. . . . . . In some cases growth is not to be obtained on any other artificial medium. Growth on nutrient agar, when it occurs, is very slow."

In the cases mentioned above I could not make out any growth on this medium (agar), being unable to isolate it; if it did develop at all, it was obscured by the more abundant growth of accompanying bacterial organisms. Both as regards its source of origin and its appearance in peptone broth it most nearly resembled Foulerton's *Streptothrix hominis I*. Of this, he states: "This species has a low degree of pathogenicity for ordinary laboratory animals, inoculation tests, either with the original pus or with pure cultures, usually failing," and later "From one other case of pulmonary streptotrichosis. . . . . . small whitish colonies of a fine streptothrix

organism, so far resembling the Species I. . . . . . were obtained in both cultures, but attempts to obtain cultures on solid media failed . . . . . .and animal inoculations, when carried out, gave negative results. In another case, one of pulmonary streptotrichosis, attempts at culture of the parasite failed, but inoculation of the sputum from the case produced, on intraperitoneal inoculation of rabbits, a fatal tuberculous kind of peritonitis, in the lesions of which the streptothrix was present in large quantities."

I regret that I could not make trial of this method in my cases.

Mr. Foulerton's fuller description of his *St. hominis I.* is: "Found and isolated in two cases of pulmonary streptotrichosis and in four cases of oral infection." Mine were both pulmonary.

"Cultural characteristics: Growth on artificial media under any conditions is uncertain, and usually scanty." In three out of his six cases growth could not be obtained beyond the third or fourth subculture on artificial media. In mine, I could not find it after the third. "On potato no growth was obtained, and on most media (except the peptone-beef-broth) growth was scanty and uncertain."

I have made special mention of these cases, because it is more than probable that a certain proportion of those giving physical signs of tuberculous infection, but without any family history of this disease and without corroboration by the finding of the *bacillus tuberculosis* in the sputum, are cases of streptothrix infection.

3. *Vomiting Sickness.*—During the last six months Dr. Seidelin's report upon his investigations into this disease has been published, and before going on to describe the cases which I have met with this year I would like to make a few remarks on the bearings which my own investigations have had in leading me to agree with or differ from his conclusions.

He states (page 14): "Either some observers have overlooked mild forms of the disease, or . . . others have included cases of a different nature . . . the latter seems the more probable." This statement I certainly agree with, because it has been my experience to find that any case of a child who vomits, whether at the onset or during the course of an illness, is put down by the laity, and sometimes also by the medical attendant, as one of vomiting sickness, if it occurs at the season when this disease is prevalent (December—March).

Also, some cases are reported as "vomiting sickness without vomiting," and others are definitely recorded as "vomiting sickness," when none of the usual symptoms of the disease are present. One case in point I may mention, and I have no reason for regarding it as unique. I was summoned to carry out the post-mortem examination of a child who had been reported at the local police station as suffering from vomiting sickness, a record of cases occurring in that part of the district being kept there. The case was that of a marasmic infant. The autopsy revealed none of the usual signs of vomiting sickness. On questioning the mother afterwards as to the history and symptoms, it turned out that the child had been wasting for over three months, had never had any vomiting or convulsions, but had "simply faded away." When I asked the reason for its being reported as vomiting sickness, the parents informed me that medicine could be obtained free at the police station for vomiting sickness patients, and, since to the uneducated medicine regardless of diagnosis is the main use of the physician, the case had been reported as one of vomiting sickness by the parents in order to obtain free medicine.

As regards the other alternative in the statement above referring to "mild forms" of the disease, these are exceedingly rare in all the districts in which I have met with it; certainly not so numerous as to reduce the case mortality from 75 per cent. (Seidelin's figures) to 2 per cent. (Tillman's estimate). My own figures up to the end of March, 1913, work out a case mortality of 81 per cent., and I may add that this year out of twenty cases reported to me only two have recovered, giving a mortality of 90 per cent., or deducting those for which other cause of death may be given or where the symptoms were not those usually characteristic of vomiting sickness, there were two recoveries out of sixteen cases, or a mortality of 87·5 per cent. Also, of those seen by me, or reported to me, less than half a dozen could be justly spoken of as "mild"—clinically speaking—unless by the term "mild" is meant "rapidly recovering," because, as the histories previously reported by me of

184 cases have abundantly shown, those appearing but little indisposed at the beginning of the illness may suddenly be attacked by convulsions, become comatose, and die in a few hours. Of all the cases seen by Dr. Seidelin five, or possibly six, might be described as mild, and this experience coincides with my own. The inference is, therefore, that the weight of evidence is strongly in favour of Dr. Seidelin's second alternative, that those who report such a low mortality have included cases of a different nature (different, that is, from true vomiting sickness).

As regards the term "black vomit" as one of the synonyms of the disease, I think that this is an error, and should no longer be maintained; of over 200 cases reported to me in detail, only two had any vomiting so described, and amongst those seen by me personally I have never met with a case in which the vomit was black, and if employed as a synonym at all, it is, I feel sure, the one used least frequently. The vomitus in all that I have seen had been in the main mucoid, watery, or frothy, while very occasionally, if there has been much straining or retching, it may be pinkish from admixed blood.

Dr. Seidelin's remarks on page 21 of his report, on the question of "emaciated subjects," agree with my own experience. Nearly all the cases which I have seen have been fine, well-nourished children.

On page 23 he refers to the organisms present in some of the cases. It was owing to the varied sugar reactions of the Gram-negative diplococci isolated in different cases that in my report of March, 1913, I expressly gave as the title of Table II. of the appendix, "Cases in which a Gram-negative diplococcus was isolated from the cerebro-spinal fluid," and purposely avoided calling the organism the meningococcus, except in the first series—the Peart cases—in which the typical meningococcus reactions were given.

The points put forward on pages 86 and 87 of Dr. Seidelin's report appear to give the quietus to the yellow fever theory; namely:—

i. The class of persons attacked—the native population only, never foreigners;

ii. The age of persons attacked—yellow fever in children usually a benign disease, whereas in vomiting sickness in my series of cases 65·57 per cent. occurred below the age of six years, with a percentage mortality of 80;

iii. The seasonal prevalence—becoming rare or dying out during the hot and rainy seasons, and becoming epidemic during the cool and dry winter months;

iv. Duration of the disease. In the cases of yellow fever mentioned in his Yucatan report, death in the majority of severe cases occurred on the fifth, or occasionally on the fourth, day of disease, whereas in my series of 184 cases the average duration of vomiting sickness cases worked out at 14½ hours (see March, 1913, report, Table IV. in appendix);

v. "The classical clinical symptoms of fatal yellow fever—fever, black vomit, jaundice, and anuria—are almost constantly absent" (page 86).

In my own defence I would like to state a few facts with reference to Dr. Seidelin's remarks on page 88: "The evidence is that meningococci have been found by Scott in the cerebro-spinal fluid in a considerable number of cases of vomiting sickness. Scott himself, however, in his latest paper is less positive," etc. This arose from the fact that the first cases actually seen by myself were the "Peart" series in September, 1912, which were definitely instances of cerebro-spinal meningitis. Later on, as I became better acquainted with vomiting sickness, it was obvious that cerebro-spinal fever and vomiting sickness were two distinct affections, though with certain more or less closely resembling symptoms, or perhaps it is better stated by saying that under the term "vomiting sickness" had been grouped cases of cerebro-spinal meningitis (which occur in small numbers) and in far greater numbers cases of vomiting sickness proper.

Finally, before passing on to speak of my investigations this year, I would like to add that I consider Dr. Seidelin's report an excellent one, and the fact that the problem of causation has not been solved does not detract from its usefulness, though, of course, the solving of it would have enhanced its value. It is an

exceedingly fair and impartial statement of our knowledge of the disease to the present time, showing no hasty jumping to conclusions, no bolstering up of preconceived ideas, but a calm, judicial summary.

This year the disease has been exceptionally limited, for whereas by the end of March, 1913, I had 185 cases reported to me and specimens had been sent up from most of them, this year I have had reports of only 20. Several of these occurred within a few miles of Kingston, so that I had the good fortune to be able to investigate them at first hand.

A few details of each of them will be given. Dr. Lofthouse, District Medical Officer of Balaclava, has reported three cases :—

1. E. C., female, aged six years. Apparently quite well till 11 a.m., 8th January, when she suddenly felt ill and lay down. Shortly afterwards she began to vomit; she vomited twice, then passed into a comatose state and died without recovering consciousness at 6 p.m. She had no convulsions. Duration of illness seven hours.

   No statement was given as to the previous meal, character of vomit, etc.

   Blood smears were sent from this patient and showed a remarkable condition. There are a few nucleated red corpuscles and there was a great increase in the number of leucocytes. A differential enumeration of these yielded the following results: polymorphonuclears 42 per cent., large mononuclear 1 per cent., large lymphocytes 6 per cent., small lymphocytes 41 per cent., eosinophiles 0·5 per cent., transitionals 0·5 per cent., myelocytes 9 per cent. At the autopsy the small intestine "contained several round worms," but everything else was reported to be normal. No tissues were sent, and as the spleen and lymphatic glands were both stated to be normal I cannot conjecture the cause of death in this case.

   Dr. Lofthouse states, "No obvious cause of death revealed at autopsy."

2. E. L., male, aged six years, black. "Sudden onset of illness with vomiting, which was repeated; the patient then passed into a comatose state." Death occurred two hours after the first onset.

   At the post-mortem examination some round worms were found, but the only point worthy of note apparently was that the "spleen was very large." "No cause of death revealed at autopsy." Again from this case blood-smears were sent, but no tissues. No enlargement of the lymphatic glands noted.

   Here also the smears showed a great increase in the leucocyte numbers, particularly the mononuclear variety, and a differential count gave: polymorphonuclears 26 per cent., large mononuclear 1 per cent., transitional 1 per cent., large lymphocytes 9 per cent., small lymphocytes 50 per cent., eosinophile 1 per cent., myelocytes 12 per cent.

   No smears from cases either before or since which have been examined by me, revealed these peculiar features.

3. K. L. W., female, aged two years, black. Apparently well till 6 p.m., 21st March, when she cried out and had a fit, lost consciousness and died at 9 p.m. Duration three hours. There was no vomiting at all. At the autopsy, 15½ hours later, the only abnormality recorded was that there were "dozens of round worms (ascarides) in the intestine"; the vessels of the cerebral cortex were said to be engorged.

   This case ought not, I think, to be included. The diagnosis at any other time of the year would have been "infantile convulsions associated with intestinal worms," but because death occurred in three hours and during the cooler months it is reported as "vomiting sickness without vomiting." (See above, page 6.)

4. One case has been reported by the District Medical Officer at Gayle.

   J. W., male, aged two and a half years. Suddenly seized with vomiting and convulsions at 6 p.m., 19th March; became comatose and died at 9 p.m. Duration three hours.

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Autopsy carried out 36 hours or more afterwards, and report states that "except for 20 round worms in the intestines and slight congestion of meninges, nothing abnormal found."

Spinal fluid was sent, but only a *B. coli* growth resulted.

From Falmouth eight cases have been reported to me, but in most the reports are very meagre, the history incomplete, the post-mortem conditions cursorily described, and the tissues sent very decomposed.

The difficulty in obtaining a good history is very great; the patients are in many cases not seen by a doctor during life, and the replies of the parents will usually vary with the form of the questions.

Details of each need not be given unless there are reasons to suppose them reliable.

5. A. L., female, aged six years. Duration of illness eight hours; not seen during life.
6. H. C., female, aged 27 years; mother of the last. Started to vomit on morning of 5th February, and this symptom persisted till she came to hospital on the afternoon of the following day. The only note on the symptoms is: "Cold sweat over face and hands, pulse small and weak, no pain or tenderness."

   Vomiting ceased next day and patient made good progress. Duration about 48 hours.
7. B. C., female, aged 15 months; lived about 200 yards from last. Started to vomit at 11 p.m., 6th February, and was brought to the doctor two hours later; the vomiting ceased after the first dose of a mixture containing Sp. Ammon. Aromat. and Acid Hydrocyan. dil., and the child returned home the same morning quite well.

   There is very little reason for calling this a definite case of vomiting sickness. It is true there was vomiting, but no other of the usual symptoms, convulsions, loss of consciousness, etc.; and children of the age of this patient (15 months) may readily vomit from a variety of causes. Probably nothing would have been heard of this had not the previous two cases occurred close by.
8. P. W., male, aged six years, black. Said to have vomited *once* only, and shortly afterwards lost consciousness and died in two hours. No other details given. I do not think this patient was seen by a medical man.
9. C. N., male, aged four years, black. "Vomiting, convulsions, and death" in 4-6 hours. Not seen during life by a doctor; but at the post-mortem, "Intestines packed with round worms, forming almost impassable masses in parts of lower ileum." Nothing else abnormal noted.
10. D. C., male, aged eleven years, black. The history in this case is unusual, both as regards length of disease and sequence of events. Complained of "bad feelings in the stomach" early on 25th February, refused food during that day, and went to bed still complaining. During the succeeding night he vomited once, then lost consciousness and died about 20 hours after the first sensations of illness. At the autopsy it was stated that the "liver appears fatty," "Mesenteric glands enlarged," "Pancreas very fatty." Nothing else abnormal. Microscopically, the pancreas showed hæmorrhage and a certain fibrosis in excess of the normal.
11. L. W., female, aged six years, black. This patient also did not give a typical history. She "began to have fits" during the morning of 27th February, and lost consciousness; then vomited twice and remained unconscious till death. Duration four hours.

    At the autopsy the following abnormalities were noted by the District Medical Officer:—

    Pericardium filled with dark stained fluid.
    Intestines contained about a dozen round worms.
    Pancreas appeared hæmorrhagic.
    Mesenteric glands enlarged.
    Cerebral meninges covered with petechiæ.

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Tissues were sent up to the laboratory, but insufficient preservative had been added and the whole were badly decomposed.

12. W. S., male, aged seven years, black. Suddenly taken ill with vomiting at 2 a.m., on 28th February, and this symptom continued till death three hours later; no statement as to presence of convulsions, coma, or as to the physical conditions. Probably not seen by a doctor during life.

We now come to the last series of eight cases; of these I am able to give fuller notes, because they all occurred within a short distance of Kingston, and I was able to perform the post-mortem examinations in each case myself.

1. J. E. B., male, age three and a half years, black. Apparently well on Thursday, 12th February, when he vomited three times, without effort, after taking food—vegetable soup, of which he only had the liquid. He did not seem ill and kept trying to take the soup, but each time brought it up again.

   Later he had some tea and retained it; "quite himself next morning." No other symptom (appeared quite well and took food as usual) till 7.30 a.m., 14th February. Then complained of not being well, but had no pain. He got up and lay down on the ground. Between 8 and 8.30 a.m. his mother went to take him up and found him "in a fit"—arms stiff, hands clenched and shaking. He had no more vomiting, but these "spasms" recurred frequently and the child never regained consciousness. Pulse soft and regular; respiration natural. No Kernig's sign, no rigidity of neck muscles. Sores on lips and at left angle of mouth and below nostrils.

   Was brought to Dr. Edwards at 2 p.m., and died at 3.30 p.m.
   Duration : i. From first vomiting, about 44 hours.
   ii. Intermission of 36 hours, during which he seemed quite well.
   iii. Final attack eight hours.

   No others in the family attacked.

   Autopsy : Abrasions by mouth and nose. No jaundice or discolouration of conjunctiva. Respiratory system : Trachea injected, contained frothy mucus. Lungs crepitant all over. Small patches of emphysema. No petechiæ on pleura; glands very slightly enlarged. Circulatory system; ½ oz. pinkish fluid in pericardium; few small petechiæ over upper and posterior surface of right ventricle. Valves normal; muscle slightly pale.

   Abdomen : liver 420 grms., nutmeg-like and congested, dark. Spleen 37½ grms., two accessory spleens present. Patches of greyish-pink mottling on surface and in interior. Kidneys showed slight congestion of secretory portion, more in left than right; otherwise apparently normal. Stomach contained ½ oz. of pinkish, grumous material. Mucous membrane injected all over fundus and at lower part a more congested area, 2 by 1cm., almost ecchymotic and showing possible superficial abrasion. Small intestine showed Peyer's patches swollen and slightly hyperæmic. No worms of any kind. Large intestine : Solitary follicles enlarged and stained brownish at lower part. Appendix 12·5cm. in length, contained fæcal matter. Pancreas normal. Mesenteric glands enlarged and hyperæmic.

   Head : Meninges of surface of brain showed engorged vessels, but no opacity or effusion. No excess of fluid in ventricles. No spinal meningitis, but vessels of cord injected.

With reference to this case I received a telegram at 2.30 p.m., and immediately went to the case with Dr. Edwards, arriving just at the moment of death, and was thus able to take specimens of the blood from a vein in large quantities of broth for culture, and also to make cultures of the cerebro-spinal fluid taken by lumbar puncture.

I returned immediately to the laboratory and placed all the cultures in the incubator, half of them aërobically and half anaërobically.

The next morning early I carried out a complete post-mortem examination, and took specimens of the following tissues :—

In Flemming's solution : Mesenteric lymph nodule, pancreas, heart muscle, liver, spleen, kidney, suprarenal.

In Schaudinn : Lung, spleen, kidney, suprarenal.

In formalin : Hypophysis cerebri, spinal cord dorsal and lumbar regions, cerebral cortex, basal ganglia, cerebellum. Smears of blood (also before death), spleen smears, brain smears, and urine.

Briefly the tissues all showed in various degrees the changes so ably described in Seidelin's report, so there is no need for me to give them in detail.

Blood cultures I had never before had the opportunity of making under conditions in which one could be certain of ensuring against accidental contamination; nor had Dr. Seidelin any opportunity of making cultures of the blood and spinal fluid and incubating both aërobically and anaërobically. The cultures were all kept for over a week, and two of them for three weeks, but no growth whatever occurred in any of the tubes.

2. D. G., male, aged three years, black. Apparently quite well till 3 p.m., 15th February, when he vomited; then recovered and played about till going to bed at 7 p.m., woke up at 10 p.m. and called for water; vomited and again went to sleep. Shortly afterwards he was heard to groan, and at 11.55 p.m. was seized with convulsions and died an hour later. Total duration ten hours, with interval of seven hours' calm period.

   Autopsy : Body well nourished; sclerotics slightly yellow. Thorax : No affection of lungs or pleura; trachea faintly injected in lower part. Bronchial glands not enlarged. Heart muscle a little pale, but otherwise normal, valves competent. Thymus 5 × 4 × 1·5cm.

   Abdomen : Liver shows yellowish patches on surface, spleen 7 × 5 × 2·5cm.; Malpighian corpuscles prominent. Stomach contained pale, grumous matter; fundus towards pyloric end markedly injected. Mesenteric glands enlarged, not hyperæmic. Intestine (small) showed congested patches in jejunum all along and petechiæ scattered; congestion very marked. Large bowel loaded. Appendix 6·5cm., slight constriction 2cm. from tip. Kidneys normal, pancreas normal.

   Brain : Vessels of surface engorged; membranes transparent; substance apparently normal.

   Death might equally be due to infantile convulsions with gastro-enteritis.

I did not see this case till the autopsy, 13½ hours after death. The cerebrospinal fluid was clear, flowed drop by drop, and on culture on Nasgar yielded a gram-negative diplococcus which gave rise to acid in glucose, maltose, and galactose, and after four days a faintly acid reaction also in mannite.

3. C. L., female, aged one year, black. "Attack of vomiting just before 6 p.m., 3rd March, followed by convulsions, died in fifteen minutes." Said to have always been subject to vomiting; had teething trouble. Duration 15 minutes. At the autopsy : Sore at each angle of mouth; body well nourished. No jaundice of scleræ. Thorax : Trachea injected throughout length, lungs congested at bases, possibly a post-mortem change. Slight adhesions at apices of both pleuræ. Heart normal; about 30cc. of straw-coloured fluid in pericardium. Thymus normal. Abdomen : Liver fatty, not enlarged, spleen normal; intestines showed congestion in patches, mostly at upper part and in duodenum. Pancreas congested, but showed no hæmorrhages. No worms present. Stomach showed marked congestion and petechiæ at cardiac end. Kidneys slight congestion, capsules not adherent. Mesenteric glands enlarged and hyperæmic. Peyers' patches prominent and congested. Brain : Vessels of cortex engorged, petechiæ in brain substance; no excess of fluid in ventricles or at base. No fluid obtained by lumbar puncture.

No history could be obtained as regards diet, but this case, from the extreme rapidity and from the history of vomiting and gastric trouble since birth, was

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probably an ordinary attack of infantile convulsions, very likely arising from dietetic irregularities, rather than a case of true vomiting sickness.

4. L. R., female, aged two years, brown. All the history obtainable of this patient was that she was taken ill at 4 a.m., 4th March, with vomiting. Fits supervened at 5 a.m., lasted till death, which took place shortly before 6 a.m. Duration two hours.

   Autopsy: No jaundice. Trachea slightly injected, both lungs congested; retropharyngeal glands enlarged and hyperæmic. Pericardium contained half an ounce of clear fluid. Heart showed small epicardial hæmorrhages and a small subendocardial hæmorrhage at the base of the left posterior flap of the mitral valve. Liver showed pale patches on the surface; grey-brown on section with paler patches. Spleen was slightly congested, Malpighian bodies prominent. Stomach was markedly congested, especially at the orifices. Intestines: Mucous membrane somewhat congested throughout, Peyers' patches enlarged; 15 ascarides present. Pancreas hyperæmic, not enlarged. Mesenteric glands enlarged and hyperæmic. Kidneys hyperæmic, but otherwise normal macroscopically. Brain showed engorgement of the cortical vessels; ventricles contained excess of clear fluid. Serous meningitis, gelatinous looking.

   The ventricular fluid showed many cocci, diploid, mostly extracellular (not all); Gram-negative, but not easily decolorized (? staphylococci); also a Gram-negative bacillus (*coli*), possibly a postmortem contamination.

5. O. F., female, aged 25 years, black. Was taken ill at 5 a.m., 9th March, with "vomiting and fits"; was given warm milk and appeared to be quite well during the remainder of that day, but vomited again during the evening of 9th, fits recurred, followed by coma, and death at 9.30 a.m., 10th March. Her child, aged four years, said to have died with similar symptoms after an illness of one hour on the previous day (9th).

   Autopsy: No jaundice; scars of old yaws present. Sores on lips; poorly nourished (was confined three months previously). Thorax: Adhesions, not very firm, at side and posteriorly, of right pleura. Interlobar adhesions in left lung. Trachea injected, petechial. Lungs congested in patches, especially upper lobe of right lung. Bronchial glands enlarged. Heart: pericardium thickened in patches, with myocarditis beneath. Valves normal.

   Abdomen: Liver friable, weight 51 ounces. Spleen small, much lobulated, dark, pulpy. Stomach: petechial patches present, also in small intestine; Peyers' patches in one or two instances picked out in petechiæ. No worms found. Pancreas fibrous and tough. Polypoid excrescence, 5mm. in length, in jejunum. Retroperitoneal glands enlarged and hyperæmic. Inguinal glands showed similar condition. Kidneys congested, especially in secretory part.

   The brain showed milkiness at base, especially over the cerebellum. Cerebro-spinal fluid smears and cultures taken. From these latter Gram-negative diplococci developed, which were inclined to grow in chains. This organism produced acid, but no gas, in dextrose, maltose, and galactose in 48 hours, and after six days slightly also in mannite and raffinose.

6. The history of this case is a little unusual, in that convulsions preceded the vomiting by some three hours. This is the only case, too, where any details as regards the nature of the preceding meal have been obtainable. On one's attempting to elicit this information the native immediately puts himself on his guard, I presume because he thinks that he may get into trouble if there is any suspicion of poisoning, and the almost invariable reply is "usual food," or "milk," or "pap," or "the same as ourselves." This is in many cases, I am sure, erroneous.

   M. Coolie, female, aged three years. Went to bed well on the evening of 10th March. Meals that day: fresh pork (but one of the parents

said "salt pork") for breakfast, rice and peas in the evening. Woke at 3 a.m., 11th March, cried out (not complaining of any pain) and had a fit. These succeeded one another rapidly till 6 a.m., when the child vomited yellow "bilious" matter, then became comatose and remained so till death. Duration six and a half hours.

Autopsy: Body well nourished; slight sore fissures at angles of mouth, no jaundice. Thorax: Lungs crepitant all over, lower lobes congested in both (post-mortem 24 hours after death). About 6cc. of clear fluid in the pericardium. Heart muscle a little pale. Thymus 6 × 4 × 1·5cm. Abdomen: Liver dark, with pale patches on surface, dark on section, uniformly friable. Spleen showed patchy congestion with prominent Malpighian bodies. Stomach contained light brown grumous material, mucous membrane congested; small petechiæ, especially at cardiac end. Intestines contained four ascarides, no congestion; Peyers' patches prominent, but neither congested nor swollen. Kidneys both deeply congested. Bladder fairly full of pale urine. It contained no albumen, nor casts.

Head: Cortical veins congested, brain substance pale; the ventricles contained an excess of turbid, slightly blood-tinged fluid. Coliform organisms only developed on culture.

7. This case should not, in my opinion, be reported as a case of vomiting sickness at all. It was probably a case of epilepsy of long standing, terminating in status epilepticus and exhaustion.

L. W., female, aged 21 years, black. History of having been subject to fits. Last evening, 16th March, at 6.30 p.m., she had a succession of these fits, from which she never recovered, remaining unconscious throughout, until death at 8.30 p.m. *There was at no time any vomiting.*

Autopsy: Thorax: Trachea shows several small petechial patches, and one larger submucous ecchymosis just below the left vocal cord. Lungs showed scattered tuberculous areas, and larger deposits at left apex. Bronchial glands enlarged, not caseous. Heart normal. Abdomen: Liver weighed 1,950 grms., showed perihepatitis, tissue mottled, dark brick-red on section. Spleen 1,050 grms., perisplenitis present, tarry on section, but firm (cut like damson cheese). Stomach much congested and showed petechiæ. Intestines normal in appearance. but contained a mass of ascarides. Kidneys very pale, cortex and medulla distinction poorly marked; pyramids hazy, porcelain-like.

Brain very pale, membranes adherent, especially in parts, no tumour of brain discovered. Diagnosis: Status epilepticus, or possibly uræmic convulsions. No urine was obtainable for examination.

8. This patient was not seen during life by any doctor. No details of the history were obtainable; the post-mortem examination was not made till 40 hours after death, when decomposition had set in. The only reason for including it in the list is that it was reported as a case of vomiting sickness, though, on further inquiry, I found that the authorities for this were only the parents and the constable at the local police station.

S. N., male, aged two and a half years, black. Said to have been taken ill at 4 a.m., 15th March, with vomiting and diarrhœa, and died at 6.30 p.m. the next day. Duration 38½ hours. No history of any convulsions, etc.

The stomach was found congested (petechial) more towards the pylorus, and the upper part of the small intestines showed similar changes; and the case was very likely one of acute gastro-enteritis.

As regards age and sex the cases this year agree almost exactly with those of last. Thus, no cases occurred under the age of one year; only three between the ages of one and two; five were three years old, two were four years, and five between the ages of five and six. Over this age one each occurred at 7, 11, 21, 25, and 27, respectively, so that 75 per cent. were six years old or under.

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With regard to sex the cases were exactly divided, ten being male and ten female.

Only in one instance, that of D. G. (page 11) was a diplococcus obtained from the cerebro-spinal fluid, giving the morphological and cultural characteristics of the meningococcus; and this was not quite typical in its sugar reactions, producing faint acidity in mannite after four days.

In another case, that of O. F. (page 12), diplococci negative to Gram's staining method, but atypical in tending to grow in chains, and in producing acid in mannite and raffinose, were present.

I wish to state that in dealing with the morbid anatomy Dr. Catto has been of great assistance in this part of the investigation, for it would have been impossible to carry out both the bacteriological and anatomical researches unaided. To him, therefore, was relegated the work of cutting and staining the sections of the various tissues and organs, and I am greatly indebted to him for the ability with which he has performed this part of the work.

Although the cases this year have been few in number, only about one-tenth of those reported to me last year, nevertheless, they occurred in such close proximity to the laboratory that we have been able to carry out certain investigations which could not be done last year, and, in fact, some experiments we performed had never been tried previously. These were:—

i. Anaërobic cultivation of blood taken direct from the circulation, as well as aërobic.
ii. Anaërobic cultivation of the cerebro-spinal fluid.
iii. Animal experiments (in addition to those carried out last year when Dr. Seidelin was here).

Briefly, the results of all these may be summed up in the word "negative," but this does not mean that no inferences can be drawn from them.

1. I had always been hoping for an opportunity of obtaining a good blood culture at the point of death, for if the condition be due to a bacteriæmia it was probable that the organism would be best obtained then; I therefore kept materials ready for an emergency call, and an excellent opportunity arose in the case of J. E. B. (page 10). This was a typical case in practically every respect; the age, the history, the length of disease, the period of intermission, the more fulminating termination, all were typical. The pathological findings at the autopsy were those generally found, and there were no worms present to complicate matters.

   All the blood cultures, aërobic and anaërobic, remained sterile; I made eight of these and incubated four in each way.

   There will probably be no further opportunity of confirming these findings (or rather absence of findings) this year, but there may be next. However, every care was taken to make the examination complete in the above case, and, by putting up several cultures, to check my own results, so that if these be taken as correct, the *natural inference is that the condition is not a septicæmia.*

2. In this case also the spinal fluid showed no organisms either in smears, or culture in broth, on nasgar, or on blood-agar.

   This tends to show that (apart from true meningitis cases, such as the "Peart series," reported last year) the cocci found in some of the cases are either accidental concomitants or else merely part causes, and only in a few of the cases.

   The fact of this variability tends to support this view; variability, that is, as regards form—sometimes in groups, occasionally in chains; as regards staining reactions—sometimes decolorize much more readily by Gram's method than at others; and as regards sugar reactions—galactose is sometimes unaltered, mannite is less often rendered acid, and in the latter the reaction is usually delayed, and in one case, above quoted, raffinose altered at the end of five days. This coincides largely with Dr. Seidelin's view of these organisms.

3. Animal feeding with gastric contents in two cases produced no results; intraperitoneal inoculation killed rapidly, but with signs of general peritonitis, not those of vomiting sickness.

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Our work on vomiting sickness this year, in spite of the paucity of cases, has not, I venture to think, been barren of results; and, following up my summary in the 1913 report, I would add :—

1. That the weight of evidence is against the disease being due to a bacteriæmia.
2. That the rapidity of progress of symptoms with early fatal termination (or, in rarer instances, rapid and complete recovery) rather indicate the action of a poison.
3. That, in view of the early symptoms being gastric, and the cerebral succeeding soon after, this poison is produced in and absorbed from the stomach; (the gastric and duodenal congestion present tend to support this).
4. That, since feeding experiments have proved negative, and chemical tests (which in former years have been repeatedly tried by the Island chemist) have revealed none of the usual poisons, and no signs of alkaloids, the poison (if such it be) is one which rapidly leaves the stomach or is rapidly decomposed; for example, it may be of the nature of a glucoside.
5. That it rapidly spreads over the whole body, as is evidenced by the hæmorrhages and other changes present in almost every organ and tissue.
6. That it produces its effects (apart from the clinical symptoms arising from cerebral causes) in the main upon the liver, as evidenced by the extensive fatty changes set up in that organ.
7. That, seeing the enormous mortality (90 per cent. of the cases reported to me this year), the first indication for treatment which can be deduced from the above theory—for it is little more than theory and conjecture, though based on observed facts, until the poison be isolated and its antidote found—is to wash out the stomach at the very earliest opportunity.

The only suggestion I can offer as to the source of this hypothetical poison is that, since one can never obtain any history to implicate any particular article of food, it is due to something which is apparently dangerous only at certain times of the year, some fruit, perhaps, or vegetable, or what, in my opinion, is more probable, some growth (fungus, yeast, mould, etc.) on or in this food, rendering it toxic.

The disease rarely attacks adults, as it would if it were due to ordinary food poisoning; it almost never attacks the infant in arms, but it attacks mainly those at the toddling age (75 per cent. this year); amongst the poorer natives the children get the minimum of attention, and there is every opportunity for them to pick up unripe, or otherwise unsuitable, food from the ground and eat it, without their parents even being aware that they have done so.

Appended hereto are various tables setting forth details of the work done during the last six months.

I have, &c.,
H. Harold Scott,
M.D. (London), D.P.H.,
Government Pathologist.

The Honourable
The Superintending Medical Officer.

Table I.

Showing the number of specimens sent up for Widal's reaction, month by month, and the results :—

Enteric Fever.

Month.	Typhosus.	Paratyphosus.	Negative.	Doubtful.	Double.	Totals.
September 20th-30th	7	2	10	5	—	24
October	19	32	51	12	10	124
November	17	14	37	6	8	82
December	17	6	37	—	2	62
January	21	10	22	6	4	63
February	11	21	21	4	6	63
March 20th	19	9	16	7	5	56
Totals	111	94	194	40	35	474

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Table II.

Showing the various districts from which specimens of blood have been sent up for Widal's reaction, with the results :—

District.	Typhosus.	Paratyphosus.	Negative.	Doubtful.	Double.	Totals.
Alexandria	4	—	—	—	—	4
Annotto Bay	8	4	16	2	8	38
Black River	—	1	1	—	—	2
Brown's Town	—	—	—	—	1	1
Buff Bay	2	1	2	4	1	10
Chapelton	1	1	3	—	1	6
Clark's Town	—	—	1	—	—	1
Gayle	—	—	4	—	—	4
Hospital, including Kingston ...	46	35	76	11	8	176
Linstead	2	3	4	1	2	12
Lionel Town	1	—	3	—	—	4
Mandeville	6	4	7	—	1	18
May Pen	—	2	—	—	—	2
Montego Bay	11	12	9	2	3	37
Morant Bay	—	1	3	2	1	7
Plantain Garden River	3	3	13	1	1	21
Port Antonio	10	10	19	6	2	47
Port Maria	6	6	6	1	1	20
Richmond	2	—	4	4	—	10
Sav-la-Mar	—	—	1	—	—	1
Spanish Town	5	4	3	1	2	15
St. Andrew	2	5	9	5	2	23
St. Ann's Bay	2	2	9	—	—	13
Others (2)	—	—	1	—	1	2
Totals	111	94	194	40	35	474

Table III.

Details of helminthiasis in various districts :—

District.	No. Sent.	Negative.	Ankylostomiasis Alone.	Ascariasis Alone.	Trichocephalus Alone.	All Three.	Ankylostomiasis & Ascariasis.	Ankylostomiasis & Trichocephalus.	Ascariasis & Trichocephalus.
Alexandria	14	2	3	1	2	4	1	1	0
Annotto Bay	16	3	9	0	0	1	0	3	0
Black River...	74	18	17	9	2	5	10	11	2
Buff Bay	160	13	102	2	1	8	16	12	6
Chapelton	61	11	7	1	7	17	2	10	6
Falmouth	79	2	8	4	8	29	4	15	9
Kingston (and Hospital)	43	9	11	2	1	9	2	5	4
Linstead	131	10	16	4	6	39	18	26	12
Lionel Town	309	112	73	23	36	19	15	18	13
Lucea	16	1	8	0	0	1	3	3	0
Mandeville	54	7	5	7	3	15	9	5	3
May Pen Poor House	13	1	0	1	0	7	3	1	0
Montego Bay	119	28	31	8	10	19	3	13	7
Plantain Garded River	42	13	17	1	0	0	6	5	0
Port Maria	83	5	58	1	1	3	9	6	0
Spanish Town	11	2	0	3	1	2	0	3	0
St. Ann's Bay	79	6	6	2	8	28	8	13	8
St. Mary's Poor House	28	5	8	0	2	2	2	9	0
Others	6	0	0	0	0	2	1	2	1
Total	1,338	248	379	69	88	210	112	161	71
Percentage on Positive Results ...	No. positive 1,090	—	34·77	6·33	8·07	19·26	10·27	14·77	6·51

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Table IV.

Showing the percentage of helminthiasis in general and of ankylostomiasis in particular in certain districts, from which over 100 specimens have been sent :—

District.	Helminthiasis.	Ankylostome Alone.	Ankylostome Alone and in Combination.
Buff Bay	91·87	69·38	93·87
Linstead	92·36	13·22	81·81
Lionel Town	63·75	37·05	63·45
Montego Bay	76·47	34·06	72·52
Whole Island	81·46	34·77	79·08
Whole Island exclusive of Lionel Town ...	86·78	34·26	82·53

Table V.

Showing the specimens examined month by month at the laboratory :—

Subject.	September.	October.	November.	December.	January.	February.	March.	Total.
Enteric fever	24	124	82	62	63	63	56	474
Smears	22	34	37	43	84	69	65	354
Fæces for ankyl.	98	261	226	253	200	190	110	1,338
Fæces for amœbæ ...	7	12	14	17	16	19	6	91
Urines	8	9	10	11	31	31	20	120
Pus	12	4	10	6	11	14	9	66
Sputum	11	14	17	24	15	36	24	141
Tissues	7	3	4	6	26	74	129	249
Waters	2	14	15	3	19	10	—	63
Miscellaneous	30	32	28	43	67	95	80	375
Totals	221	507	443	468	532	601	499	3,271

No. 7.

JAMAICA.

The GOVERNOR to the SECRETARY OF STATE.

(Received 3rd November, 1914.)

Sir, King's House, Jamaica, 16th October, 1914.

In continuation of my despatch, dated the 20th April, 1914,* I have the honour to transmit, for the information of the Committee of the Tropical Diseases Research Fund, the report of the Government Bacteriologist on the work done at the Pathological Laboratory during the period from 1st April to 30th September, 1914.

I have, &c.,
W. H. MANNING,
Governor.

Enclosure in No. 7.

Six-Monthly Report on the Work Done at the Pathological Laboratory, March-September, 1914.

The Pathological Laboratory, The Public Hospital,
Sir, Kingston, Jamaica, 3rd October, 1914.

I have the honour to forward herewith, in accordance with the instructions of the Right Honourable the Secretary of State for the Colonies, for the information of the Tropical Research Committee, my seventh half-yearly report on the

* No. 6.

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work carried out at the Pathological Laboratory, for the six months ending September, 1914.

The staff of the institution consists, as before, of myself as Government Bacteriologist, Dr. Catto, Assistant Bacteriologist, one trained laboratory attendant, a stenographer, and a boy as cleaner.

Since the outbreak of the war at the beginning of August, I have spent part of the day in assisting the officers of the Royal Army Medical Corps at the military hospital here, as three of their staff are on duty at various outstations, as arranged for by the local mobilization scheme in case of emergencies. During this time more of the routine work of the laboratory has in consequence fallen to the Assistant Bacteriologist, who, I am glad to report, has responded well to the increased demand upon his services.

A perusal of the appended Table I. will show that during the period under review a very large number of specimens has been dealt with, in fact, more than double that of the preceding six months, namely, 6,612, as compared with 3,271 during the period October, 1913, to March, 1914.

In attempting to describe the multifarious nature of the specimens sent up for examination, and in order that matters of interest may not be overlooked, I will group the work done under the two main headings of: I.—Routine, II.—Special, including research.

These will be further sub-divided as follows:—

Under I.—Routine Work:—

1. Widal examinations for diagnosis of enteric fever.
2. Other blood examinations for malarial parasites, filaria, etc.
3. Fæcal examinations for helminthiasis and dysentery.
4. Examination of rats for plague.
5. Bacterial analyses of water samples.
6. Autopsies of special cases.
7. Routine examinations of pus, urines, sputa.
8. Miscellaneous, including examinations of gastric contents, effusions and exudations, preparation of vaccines, Wasserman reactions, and so forth.

Under II.—Special Work, some details will be given of:—

1. Veterinary work—investigations into cases of contagious abortion at the Government farm.
2. Special researches into the causes of the spread and prevalence of enteric fever in Kingston.

As regards the question of research into the pathological anatomy of pellagra, this is still being carried on by Dr. Catto, but there is nothing definite at present to report, as only two fatal cases have come to our notice, and both were patients in the asylum with other diseases complicating the pellagrous condition.

I.—Routine Work.

1. *Widal Reactions for Enteric Fever.*—The number of specimens of blood sent up for this examination to be made far exceeds that of any previous six-monthly period since my arrival in the island, or since the laboratory was instituted. The largest hitherto was 561, in the corresponding period of 1913, while in the subsequent six months 474 bloods were sent up. This year 767 sera were tested by this reaction during the period under review in this report, and of these, 306, or 39·89 per cent., gave a positive result, as compared with 280 in my last report. Table IV., appended, shows that the increase arises very largely from specimens sent from Kingston (including both town and hospital) and the adjoining parish of St. Andrew.

Noticing this to be the case, I compiled from the laboratory records the figures in Table III., which are instructive in showing that, whereas in the months of April, July, and August the number of specimens sent from Kingston varied between 62 and 68, in May and June the number was nearly doubled. This, even if the percentage of positive reactions remained the same as in the other months, would mean nearly twice the actual number of cases of enteric fever, but the table shows that in June the percentage of positive cases rose to 54·12 per cent., and the actual cases (that is, blood specimens yielding a positive result) rose from 21 in

April to 40 in May and 59 in June. A somewhat similar but less marked condition of things having occurred in 1913, I started in March of this year a series of investigations into the matter, which already reveal findings of much interest and considerable importance. These are treated of in detail under Special Work, pages 7-11.

Briefly to sum up this section of the routine work, it is seen that, of 767 sera examined, 306 reacted positively, and of those 306 agglutinating sera, 196, or over 64 per cent., came from Kingston and St. Andrew, and 181, or 59 per cent., were from Kingston itself, a city exposed to bright sunshine all day long nearly every day of the year, and situated with a gentle slope from the upper part right down to the sea, and therefore with an ideal natural drainage. It was in the endeavour to discover the reason for such extensive prevalence of enteric fever in a town so favourably situated that the investigation referred to was undertaken.

Owing to three cases occurring amongst the police constables in April, an investigation was carried out for the purpose of ascertaining whether any "carriers" existed in the barrack-room occupied by these men. Thirty-two specimens of blood were taken and four of them gave a positive reaction. Two of these gave a definite history of a previous attack of typhoid fever, while another constable, who stated that he had been ill with the disease in September, 1912, gave negative results, and the serum from a fourth agglutinated *B. paratyphosus*.

The excreta from all of them have been examined at intervals, but with negative results as regards isolation of the *B. typhosus* or *paratyphosus;* with such serological findings it is possible, if not probable, that one or more carriers exist, but if so they are intermittent, and at considerable intervals.

Further attempts will be made to set this question at rest.

2. *Blood Examinations for Parasites, Counts, etc.*—Six hundred and eighty-nine of these have been sent up, of which 400 were examined for malaria. In 30 of these the parasite of malarial fever was found, namely, *Pl. vivax* 7 times, *Pl. malariæ* 4, and *Pl. falciparum* 21 times; in two instances there was a combined infection of quartan and subtertian, and in one instance the parasite was different from any of the usual forms, and very closely resembled that described by Professor Stephens under the name of *Pl. tenue*, that is, the protoplasm was slender and scanty, the chromatin relatively abundant, and tending to assume bizarre forms in preference to the usual dot.

In a former report I stated that after making several blood examinations I had never yet met with a case of filariasis in a Jamaican who had not also lived elsewhere than in this island. I have only come across four cases during the last four years, and in every instance the patient had lived part of his life abroad.

Doubt has been thrown upon this remark of mine, one authority stating that, seeing that the disease occurs in neighbouring West Indian islands, careful examination would probably result in its being found more commonly than I had supposed. Accordingly, with the co-operation of the Medical Officers in charge of patients in the general hospital, I examined the blood of the in-patients at different times, both during the day and night, taking them 25 at a time, but in no instance could I discover any filaria embryos. Any patient who showed glandular enlargement, and all who showed symptoms and signs of elephantiasis, were examined, but, except for one patient who had lived for many years in British Guiana, I found no filariasis.

Lastly, in five specimens of blood sent up from cattle at the Government farm I have found the *Pirosoma bigeminum*.

3. *Examination of Fæces for Helminthiasis, etc.*—During this half-year 1,422 specimens have been examined for ova of worms, as compared with 1,338 during the preceding period, and of these 1,210 contained ova of some kind, and usually a combination of several varieties. This is a higher percentage of infection than was revealed by the figures in my last report, namely, 85·09 per cent. for the whole island, whereas, in the period September, 1913-March, 1914, it was 81·46 per cent.

Table VI. has been drawn up in order to show at a glance facts which it would take pages of writing to describe. Briefly, 38·59 per cent. of the total positive findings contained ankylostome ova only, while an additional 42·73 per cent. contained them in conjunction with ascaris and trichocephalus.

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These latter two were found singly in only 5·62 per cent. and 7·19 per cent. respectively, but in combination with others in some 45 per cent. in each case.

It is remarkable that in certain districts, notably in Buff Bay, these last two are uncommon, the ankylostome markedly preponderating. Thus, in only 13 per cent. was ankylostome combined with ascaris and trichocephalus, whereas, in others, for example, Chapelton, under 20 per cent. of the cases were infected with hookworm only, while in close upon 50 per cent. the latter was complicated with both the former. In Buff Bay, again, though helminthiasis as a whole is 2·5 per cent. less than was stated in my last report, the proportion containing ankylostome alone was 14 per cent. greater.

Sixty-five specimens have been sent up from patients exhibiting dysenteric symptoms. Of these 27 contained the amœba of this disease, and in one was found *Trichomonas intestinalis.*

4. *Examination of Rats for Plague.*—Owing to the presence of plague in Cuba and in New Orleans, a vigorous rat campaign was started in Jamaica early in the year. During the six months with which we are dealing, 2,300 rats have been examined at the laboratory. Cultivations, smears, and inoculation experiments were carried out in the cases of any rats which afforded suspicion of plague, and (in view of Castellani's statement that the bacilli may be present without any gross naked-eye lesions in the animal) of several apparently normal rats also, but with uniformly negative results.

5. *Bacterial Analyses of Water Supplies.*—Sixty-three samples have been subjected to analysis. The sources of supply to Kingston are all examined and reported upon regularly every month. In June and July of this year, owing to the comparatively large number of cases of enteric fever occurring in Kingston, the Medical Officer of Health for the city wrote condemning strongly the water supply, and particularly incriminating a subsidiary source which is only used when the output from the two regular sources is insufficient.

His statements and the widespread publication of them gave rise to a scare which, though quite unfounded, served the useful purpose of causing more analyses to be undertaken, not only of the main sources of supply, but also of individual filter-beds. These were quite up to the usual tropical standards, and the Medical Officer of Health had made the mistake of overlooking the fact that the water especially attacked by him had not been supplying the city during the period dealt with owing to its being a subsidiary supply and not required, the output from the usual sources being adequate for the requirements of the population.

As already stated, I had started investigating the subject of the prevalence of enteric fever in Kingston, and the results of these researches up to the present time are spoken of in detail in Part II. of this report (see pages 7-11).

6. One hundred and twelve post-mortem examinations of special cases have been performed. Of these the following are worthy of particular mention as being of more than passing interest:—

1.—A. G., male, aged 38 years. Admitted to hospital on 20th January and died 30th March, 1914. Briefly his history was as follows: On admission he stated that he had been ill for four months with "pains in abdomen and back." For the last two weeks he had noticed a hard swelling to the left of the middle line of the abdomen, extending to the left iliac fossa. Below the umbilicus the tumour could be felt to the right of the midline. Outwards it completely filled the space between the ribs, iliac crest, and vertebral column. It was tender to the touch, quite hard, without any soft spots (Taken from the notes made by the Medical Officer in charge of the patient). Stated that he had been losing flesh. Urine high-coloured and contained blood and blood-casts. The progress was steadily downhill till death occurred two months later.

Post-mortem: Left kidney filled up the space as above described. Firmly adherent to all the surrounding organs. Many cystic bosses. *Weight*, 7 *lbs.* 11 *ozs.* On opening there was no trace of kidney tissue, the whole was made up of cysts of various sizes up to five inches in diameter, filled with blood and blood-stained urine. The right kidney was similar, but smaller. *Weight*, 4 *lbs.* 11 *ozs.* Heart enlarged, left ventricle hypertrophied, no valvular incompetence.

It is astonishing how this man could have lived so long in apparently perfect health, to the age of 38 years, with kidneys in such a condition. The specimens have been preserved.

2.—E. B., female, aged 22 years. Admitted to hospital 8th May, with a history of having been delivered ten days previously, the membranes having been retained for that time. There was a very fetid discharge. The uterus was cleared out on the day of admission. On 10th May patient developed a cough and became dyspnœic, temperature 104° Fahr. on evening of 9th May. The base of the left lung was dull, pleuritic friction audible. Death occurred on the 12th at 8.30 p.m.

At the autopsy the lungs showed a large infarct at the base of the left and a small one in the lower lobe of the right. The heart showed ulcerative endocarditis of the tricuspid valve. The uterus was lined with dark, almost gangrenous material; an abscess 2·5 × 1·5 cm. in right ovary. The inferior mesenteric vein was thrombosed for 16 cm. of its length, and the clot was purulent.

The sequence of events in this case, therefore, was: Retained placenta and membranes, sepsis, endometritis, ovarian abscess, infective thrombosis of the inferior mesenteric vein, malignant endocarditis of the right side of the heart, with the production of septic infarcts of the lungs.

3.—C. E., female, aged 22 years. Admitted 25th August, 1914, complaining that since 21st she had been suffering from abdominal pain, at first about the umbilicus, then in hypogastric, and afterwards in right pelvic, region. On examination the abdomen was seen to be very distended and painful on palpation. The right flank was dull on percussion. Clinical signs of peritonitis present. Laparotomy performed the same day, and the intestines were found to be the seat of extensive malignant disease with perforation of the small intestine through the cancerous mass. She died early the following morning.

At the autopsy: On opening the abdomen it was found to be full of pus. Intestines and other viscera glued together by purulent lymph, but they were easily separated. The jejunum was found to be the seat of an intensely hæmorrhagic malignant growth, which had started in its wall and fixed itself on to (*i*) the intestine in the neighbourhood of the cæcum and appendix, (*ii*) the broad ligament and the ovary on the left side, (*iii*) the anterior abdominal wall in the region of the linea alba. The left portion of the broad ligament contained a cyst (parovarian ?) and the ovary on that side showed some hæmorrhage.

The cause of death was general peritonitis following on perforation of a spindle-celled sarcoma, which had started in the wall of the jejunum.

The next two cases are recorded for their rarity out here and for the strange fact that they constituted two consecutive autopsies.

4.—T. P., male, aged 22 years. Admitted 29th August, 1914, with a thready pulse and obviously very ill. The abdomen was rigid, dull on percussion in right iliac region. Temperature 101·4°. Tenderness all over the abdomen, but especially at McBurney's point. Operation performed: there was a great deal of watery fluid free in the abdominal cavity, the appendix was found to be normal. A drainage tube was inserted, but no further operative measures carried out, as patient was too ill. He died the same afternoon. At the autopsy the abdominal cavity contained abundant yellow purulent fluid, and lymph deposit matted the coils. The cause of the condition was a small, punched-out perforation of a duodenal ulcer, the size of a threepenny piece, in the first part just beyond the pylorus. There were no adhesions around it to localize the escaping contents, and the patient had succumbed to general peritonitis.

5.—C. B., male, aged 27 years. Admitted 2nd September with a history of only one day's illness. He had been quite well till the onset of a sudden abdominal pain the previous day. When admitted he was in extremis, pulse rapid and thready, temperature 96·4° Fahr., abdomen rigid, distended, tympanitic. He died the same evening three hours after admission.

At the post-mortem the abdomen was filled with a similar yellow watery fluid; the intestines showed lymph formation on the surface; a perforating ulcer, the size of a threepenny bit, was present on the anterior surface of the duodenum, about half-an-inch from the pylorus, without any adhesions at all.

Both had a sudden onset in apparently perfect health; the rapid termination, the situation of the ulcer, and the failure of all attempts at localization of the mischief were the same in both.

7. Of the routine examinations of pus, urines, and sputa, very little need be said. The numbers of each examined are stated in Table I. One case of bronchomycosis occurred in a native, and one case of streptothrix in an East Indian coolie. The signs and symptoms of the latter were almost identical with those given in my previous report. Culturally it behaved like the St. Hominis I. of Foulerton.

8. *Miscellaneous specimens.*—This subdivision includes a variety of examinations which cannot be placed under any of the previous headings. The group comprises samples of effusions, exudations, gastric contents, vaccines, cultures of suspicious pestis-like organisms from rats, Rideal-Walker estimations of disinfectant values, and finally Wassermann reactions.

A considerable number of autogenous vaccines have been prepared, and the results of their employment have been, and are, in the main, very satisfactory; so much so that they are very largely replacing stock vaccines here.

With the exception of Wassermann reactions the various items of this section need not be specifically spoken of, as they form part of the routine work of every pathological laboratory.

A new method, however, of performing Wassermann's reaction has been adopted during the last six months which has given much more satisfactory results than any of the previous ones employed here. It certainly takes longer and is more laborious than former methods, but this is more than compensated for by the increased reliability. The method is that of MacIntosh and Fildes. Briefly stated. the reliability is enhanced by standardizing all the various components each day that the reactions are performed.

Thus, the rabbit-sheep hæmolytic amboceptor is first standardized and the minimal hæmolytic dose ascertained; two-and-a-half times this is used for the test. Next, the complement obtained from the guinea-pig is standardized and the smallest quantity causing complete hæmolysis of 0·5 c.c. of a 5 per cent. suspension of fresh washed sheep's red cells, sensitized by two-and-a-half times the minimum hæmolytic dose of the amboceptor in one hour is ascertained, and for the test twice this quantity is used. It was found at first that the complement deteriorated somewhat rapidly out here, so our plan now is to obtain the blood from the guinea-pig about 3.30—4 p.m. on the day before that on which the tests are to be carried out, and place it in centrifuge tubes in the ice-chest till the following morning. After withdrawal of the blood, the heart of the animal is removed, separated from any fatty and fibrous tissue present, weighed and ground up with well-washed silver sand; 10 c.c. of absolute alcohol is added for every gramme of heart muscle, and the whole is well shaken at intervals for an hour. This constituent of the antigen is made up fresh every time. Alcoholic solution of cholesterin (1 per cent.) is added in proportion of four parts to five of guinea-pig heart extract. This is standardized, and one-third to one-fourth of the amount found necessary to completely inhibit hæmolysis of the sheep's red corpuscles, sensitized and complemented with the amounts previously determined, is used for the reaction. The antigen dilution is made immediately prior to its being used, the mixture with normal saline being rapidly performed in order to produce the minimum precipitation.

The patients' and the control sera are all inactivated by keeping them at 56° C. for half-an-hour, and are then placed in the ice-chest until required.

Thus. the amboceptor, complement, and antigen are all standardized afresh each day the reaction is to be carried out, that is, once a week. The result of the test in each case is stated according to the degree of hæmolysis as compared with a standard made as follows:—18 c.c. of tap water is added to 2 c.c. of the 5 per cent. of suspension of sheep's red cells; 5 c.c. of this is placed in a "Wassermann tube," and this is called 100 per cent. hæmoglobin. Dilutions are made from this, namely 3·75 c.c. with 1·25 c.c. saline; 2·5 c.c. with 2·5 c.c. saline; and 2·25 c.c. with 3·75 c.c. saline; to equal 75 per cent., 50 per cent., and 25 per cent. hæmoglobin respectively. In notifying the result 100 per cent. hæmoglobin = negative, 75 per cent. = very slightly positive, 50 per cent. = slightly positive, 25 per cent. = positive, while no hæmolysis = markedly positive.

Appendix VIII.

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Group II.—Special Investigations.

1. *Contagious Abortion in Cattle.*—At the request of the Director of Agriculture, I undertook some work in connexion with an outbreak of abortion amongst the cattle at the Government farm.

From the uterine exudate of one case a growth was obtained having the morphological and cultural characters of the *Bacillus abortus*, originally isolated by Bang.

A brief description may with advantage be given: It is a slender, non-motile bacillus, of an average length of 1-2 micra, gram-negative, non-acid-fast, often showing barred staining. The optimum temperature of growth is about 37° C. and the organism dies in ten minutes at 60° C. It is an obligatory aërobe. It produces little, if any, soluble exotoxin, but an endotoxin sets up febrile symptoms. On examination of smears from the uterine exudate they are seen disposed singly or in clumps between the leucocytes and catarrhal cells from the mucous membrane. They are said never to be found in the heart blood of the fœtus, but may be present in the fluid contents of the fœtal stomach. Therefore, the uterine exudate and the fœtus must both be regarded as infective; moreover, the post-abortion discharge is similarly infective. The material, if kept fluid and free from putrefaction, can retain its virulence for at least six months, which compensates for the inability to propagate outside the body.

From the foregoing it is clear that there are several ways in which infective material may be distributed to healthy animals and to other parts of the pasture, for example:—

1. The surface drains of a byre may carry the infective uterine contents to other stalls.
2. The material may be conveyed elsewhere by the removal of the soiled manure.
3. By the roaming about of infective animals and others carrying the material on their coats, soiled by lying in infective discharge.
4. By the boots and hands of attendants.
5. By dogs carrying parts of the expelled fœtus or membranes to other parts of the farm.
6. The bull may convey the infection from one animal to another, though this is probably an infrequent method.

It must be borne in mind that infection readily occurs by the mouth, that is, ingestion of the virus by pasturing on grass which has been contaminated by the discharges of an infected animal. The natural inference from this fact is that, in order to minimize the dangers of conveyance, which are very considerable, cows which have aborted must be regarded as potential sources of infection so long as the genital discharge continues, and an important fact to keep in sight is that the discharge may intermit and continue for weeks if untreated.

If isolation, therefore, is not carried out, the sheds may be constantly reinfected, or, if the animals are turned out to graze, the pastures may be similarly contaminated.

Finally, a few words as to my own work in this connexion. It is generally held that the agglutination test for the purposes of diagnosis of this condition is not very reliable. The reason for this arises, in my opinion, from the fact that the bacillus isolated by Bang in Denmark differs in several particulars from the English bacillus, and that the serum of an animal infected by the one may not necessarily agglutinate a culture of the other (Compare, e.g., the results of testing the sera of patients suffering from enteric fever due to the true typhoid (Eberth's) bacillus in one case, and paratyphoid in the other; clinically the symptoms may be identical, but the serum of the second will not agglutinate the *Bacillus typhosus*—except in low dilution—and vice versa).

In the present investigation of the cows at the Government farm, the results have been singularly accurate. Twenty-five specimens of blood were brought or sent to me to be tested, and I carried out the examination with a twenty-four to thirty-six hours' culture of the bacillus in dilutions of the sera of 1:100, 1:200, and 1:500. No hint was given to me as regards the histories of any of the animals, whether they had shown any of the symptoms of the disease or not. Some had undoubtedly

suffered from the disease, some were suspected, and some were healthy, and sera from these last were sent with the others as controls, but in no instance was I told which was which.

The results obtained are given in the appended Table VII. It will be seen that seven gave a marked agglutination in all three dilutions; seven in low dilutions only, though four gave partial reactions in high dilutions also, while two gave only partial reactions, that is, there was a considerable degree of clumping in all the dilutions, but many bacteria still remained isolated, while again nine were negative. Arguing on the lines of my previously published work on the interpretation of the reaction in enteric fever, one inferred that those giving a positive in low dilution were either in an early stage and liable to abort, or more probably had aborted a considerable time previously, and the immunity conferred by that former attack was gradually passing off.

On my reporting my results to the Director of Agriculture, I received a letter from him in which he states : "The results (of the tests) are truly remarkable, and I am able to confirm every reaction as undoubtedly correct from our own records and observations of the animals."

This fact is worthy of note in view of the somewhat adverse opinions which have been held elsewhere relative to the value of the agglutination test.

2. *Research Work on Enteric Fever.*—It has been stated above that, owing to the extensive prevalence of enteric fever in Kingston, I determined to make some efforts to discover the cause.

Naturally one's thoughts were first directed to the usually recognized sources of the spread of the disease, namely, food (including water), flies, and dust.

The regular examinations of the Kingston water supplies undertaken at the laboratory have the result of keeping the Kingston General Commissioners always on the alert to detect any evidence that the quality of any of these supplies is changing, and the fact of any additional contamination occurring would be soon discovered. It came as a matter of great surprise, therefore, when Kingston was scared by a report from their Medical Officer of Health that the water supply, and especially that auxiliary one recently installed at great expense, consisted of "diluted sewage," and could "by no method be rendered fit for drinking purposes." Fortunately, it proved to be a mere canard, for the incriminated source of supply was not in use at the time, this being only a subsidiary supply pumped up when the usual sources prove inadequate for the demands of the population, which was not then the case.

Although there were undoubtedly a larger number of cases of enteric fever notified during May, June, and July than at other times of the year, and this year perhaps more than in previous years, I do not by any means think that one can infer from this that enteric fever has been actually more prevalent than at corresponding times in previous years. It is possible but not certain. It must be remembered that the uses of the bacteriological laboratory are now firmly established, and blood is sent up from many more cases of fever now than formerly. A considerable proportion of these which would have formerly been diagnosed by the medical attendant as "malaria," "fever undefined," etc., now has to be notified as enteric, and this swells the numbers.

Again, other cases of similarly doubtful fever prove on bacterial examination to be suffering from paratyphosus infection: these also, by the present law, are notifiable under the heading of enteric fever (formerly these were not required to be notified at all), causing a further increase.

These two causes together would lead to a marked increase in the number of notifications, even if the actual prevalence were no greater than in previous years.

Against the supposition of the disease in Kingston being water-borne are the following facts :—

1. The population of Kingston is estimated at 58,352, and the notifications of cases of enteric fever include all those in the Public General Hospital, which draws also from the neighbouring parish of St. Andrew, at all events the lowest and most densely populated part of it; so that the population was over 60,000 at the very smallest computation. During the month referred to there were 50 notifications, that is,

less than 1 per 1,000, a large proportion in a town with every natural advantage for drainage, but a very small proportion as compared with what would occur if the infection were water-borne, since 58,352 individuals drink this water.

2. There were no notifications from the penitentiary or the asylum, although the same water is used there, and water from no other source.

3. The different quarters of the town, though having the same water supply, contributed very different numbers of enteric fever; thus, from the north-east, north-west, south-west, and south-east districts there were notified respectively 11, 23, 7, and 5 cases in one month, that is, 34 in the northern to 12 in the southern parts.

The water conveyance of infection being thus excluded, inquiries were made as to the other, more likely, sources.

1. Food, such as milk, etc., were possible sources, for, as in most tropical countries, milk is carelessly handled, and the cleanliness of the vendors and their receptacles is by no means above suspicion.

   Also sweets, cakes, and so forth are sold at various dusty street corners, and up to a short time ago there was no compulsion to keep these articles of food protected from dust, flies, or the fingers of would-be purchasers, who commonly take up one article after another before deciding as to which is most value for their money. I know also of one case where the sweets so sold were actually being made in a hut in which an enteric patient was lying.

2. Flies.—These are very troublesome in some parts of the city, particularly the poorer parts, whence many of the enteric cases come. In these quarters they are troublesome at most seasons of the year, but the time when they become a positive pest is that of the "mango season," from May onwards to September, and this is the time when the enteric rate goes up.

   A fly census in different parts of the town, and the establishment of a correlation between this and the district whence notifications of enteric fever come, would be an interesting matter, but is more within the province of the Medical Officer of Health than that of myself.

   With his consent I would like to undertake this at some future period, if my other duties will permit.

3. Sewage disposal.—The water carriage system is only laid on for the lower part of the town, the upper parts, north-east and north-west districts, are largely furnished with privy middens, dry earth, and so forth, nothing less than an open invitation to flies, which freely avail themselves of it.

   This also is a matter for the Medical Officer of Health, and with it I cannot interfere, but, granting all the above, there was still unaccounted for the source whence the flies or the food or the dust obtained the organisms of the disease, and one, therefore, suspected—

4. Carriers.—This was a matter with which my special work was connected, but there were several difficulties in the way of obtaining material, as people in health cannot be prevailed upon (and it is quite a natural objection) to send up excreta in order that one may find out whether they are typhoid carriers. Moreover, if negative, the case was by no means proven, as the carrying might be intermittent.

My suspicions were that there might be, and probably were, individuals going about apparently in good health who were unwittingly spreading the disease, and considering the fact, firstly, that enteric fever is a common disease here, and that probably a certain percentage of them become carriers; and, secondly, that many cases are overlooked and wrongly diagnosed, I determined to make bile cultures of every patient dying in the hospital, no matter from what condition, and to see whether any of them were carrying the bacillus in their gall-bladders at the time of death.

Of course, in patients coming in with a history of enteric fever and dying from it, and in patients wrongly diagnosed but actually suffering from the disease, one would naturally expect to find the organism, but there was a third class for which I particularly wished to examine, namely, those who were admitted into

hospital with some illness unconnected or not suspected of being connected with enteric fever, and who, by harbouring the *Bacillus typhosus* in their gall-bladders had probably been acting as carriers, and who, had they chanced to recover, would have again gone about spreading these germs broadcast. These were the ones who were dangerous to the community, and, if such were found to exist, the fact would go far to explain the undue prevalence of typhoid fever in Kingston.

The method of procedure has been as follows:—As soon after death as possible the gall-bladder was exposed, and, with the usual precautions for sterilizing the surface, an incision was made into the organ and a platinum loopful of the bile was inoculated into tubes of peptone broth (5 c.c.), to which varying quantities of brilliant green had been added immediately before. Sometimes six tubes were inoculated, but never less than three, the proportions being 5 c.c. of the broth and of the brilliant green (1 : 10,000) 0·03 c.c.; 0·06 c.c., 0·12 c.c., 0·18 c.c., 2 c.c., and 3 c.c. respectively. They were then placed in the thermostat at 37° C. and examined the following day.

If the growth was slight further examination was postponed for another twenty-four hours. If there was no growth the tubes were kept for a week. If growth took place the broth culture was plated on to rebipelagar, and subsequently any suspicious colonies into nutrient broth. Secondary tests were then carried out with various sugars, namely, lactose, saccharose, glucose, maltose, mannite, and sorbite.

I also prepared an immune serum, which gave a titre of 1 : 4000 with its own producing strain of *B. typhosus*, and any isolated organism which gave the usual typhosus reactions was tested with this potent immune serum.

I not infrequently found, as has been noted by others, the following two facts:—

1. That recently isolated organisms had in many cases lost their motility, or perhaps it would be more correct to say had not yet acquired motility. This was frequent in the primary growth in the brilliant green peptone-broth, but subculturing into nutrient broth led to a development of normal motility.
2. That at times a recently isolated strain is not readily agglutinated except in low dilutions.

In consequence of these two facts the work was increased, and the results sometimes delayed owing to the subculturing necessary before the tests could be declared definitely positive or negative. Organisms, however, which gave the typical sugar reactions were always tested, and, if necessary, re-tested again and again after an interval with the immune serum.

Only such as gave the sugar reactions and a high agglutinability with the immune serum were regarded as positive.

Agglutination of a bacillus with the serum of a patient suffering from enteric fever, as Bruns, Kayser, and others, have pointed out, is not sufficient to establish the identity of such a bacillus as *B. typhosus*, and to rely on such is open to many pitfalls.

This description of my method is very brief, but only the main points of it have been sketched. We have now made cultivations from 100 cases, and, since a description of them all would unduly prolong this report, I will only briefly summarize the results:—

1. Out of the 100 cases 25 were shown at the autopsies to be suffering with enteric fever, that is, definite macroscopic lesions of the disease were present. In 20 of these the bacillus was isolated from the bile, in other words, in 80 per cent. of the cases so far who showed definite signs of enteric fever at the post-mortem, the bacillus was found in the gall-bladder.
2. Twenty-two cases had been diagnosed clinically as enteric fever, and 18 of them were confirmed as such at the autopsies. The remaining four were (1) tuberculosis of pleura, pericardium, and bronchial glands, (2) phthisis, (3) cirrhosis of liver, (4) dysentery.
3. Eight cases were found to have died from enteric fever which had been wrongly diagnosed, or had had no definite diagnosis made at all.
4. Three cases gave no history of enteric fever and showed no typhoid lesions at the autopsy, but gave a positive result on cultivation of the bile.

Remarks: Group 1 calls for no comment. Group 2 is only so far important in that notification of them would tend to swell the number of actual cases occurring, but, on the other hand, these are more than counterbalanced by the eight included in group 3.

This last (group 3) is important in that, had they recovered there would have been no record of their having suffered from enteric fever: they might not unreasonably be regarded as possible carriers, and at any rate no warning would have been given to them relative to the risks they constituted in conveying the disease to their associates.

Group 4 is the most interesting and most important of all, and proved the suspicion on which the investigation was undertaken, namely, that unrecognized carriers are going about Kingston in larger proportions than have been estimated elsewhere.

It has been stated that 3 per cent. of patients become carriers, but out of this first series of 100 cases there have been found three who up to the time of the onset of their final illness had been going about apparently in perfect health, who gave no history of having had an attack of typhoid fever, who mixed freely with their fellows, and lived in the poorer, badly ventilated, and unsewered parts of the city.

These cases are worth quoting briefly:—

1. C. C., male, aged 49 years, white. (No. 7 in the appended list.) Admitted to hospital at 4 p.m., 31st March, with a history of having at 9 a.m. "taken rat poison in mistake for phenacetin." He died at 11.40 p.m. The fact that more than 400 grains of arsenious acid were found in the stomach and viscera, even after the vomiting which had continued for ten hours, points to deliberate suicide, for no one would take close on an ounce of phenacetin for a single dose. His neighbours stated that he went in and out amongst them apparently in perfect health until the day of his death.
2. B., a coolie woman, aged 21 years. (No. 34 in the list.) Admitted complaining of "fever, cough, and pain in the right side of the chest." Expiration was prolonged, and there were rhonchi audible over both lungs.

   The diagnosis of phthisis was made, and the patient died early the following morning.

   At the autopsy the lungs showed minute scattered nodules with caseous contents, possibly tuberculous, but the chief finding of interest was that the gall-bladder had practically disappeared, and there was an ulceration into the duodenum just beyond the pylorus, with a gall-stone about the size of a small hazel nut in the aperture.

   There were three abscesses in the liver, one cavity being the size of a tangerine orange.

   From the nucleus of the gall-stone (the only one) a pure culture of *B. typhosus* was obtained.
3. S. D., male, aged 19 years, black. (No. 73 in the list.) Was admitted with a history of six days' "cough, pain in the right side of the chest, and fever." The percussion note over the lower lobe of the right lung was quite dull. "No breath sounds could be heard, but vocal resonance and fremitus increased." Widal reaction was negative. The patient died ten days later.

   At the post-mortem the right lung was quite solid; the upper and middle lobes in a state of grey hepatization, the lower lobe in a condition of purulent infiltration, and in one place broken down to abscess formation. The lung was large and heavy, and the liver so displaced that the upper margin only reached one-and-a-half fingers' breadths above the costal edge.

   This, then, was a case of unresolved lobar pneumonia. No history whatever was obtained pointing to enteric fever, but a culture of *B. typhosus* was yielded by the bile.

It would hardly be fair to draw conclusions from 100 cases, and the investigation is being continued, but if, apart from cases treated as enteric fever at the hospital, and apart from cases showing signs of this disease post mortem, there have been among the first 100 autopsies three who were harbouring the *Bacillus typhosus* in their gall-bladders, it is not surprising that there is so much enteric fever in Kingston.

Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

The tables of these 100 cases reveal many more points of interest, but as these are not intimately concerned with the object for which the investigation was undertaken, I do not propose treating of them here, but hope, if time permits, and I have sufficient opportunity, to make notes of further cases and publish them as a separate paper.

I have, &c.,
H. Harold Scott,
M.D. London, D.P.H.,
Government Bacteriologist, Pathologist
to the Kingston General Hospital.

The Honourable
The Superintending
Medical Officer.

Table I.

Showing the numbers of specimens examined month by month.

	March 21st—31st.	April.	May.	June.	July.	August.	September 1st—20th.	Totals.
Blood for Widal's test	33	101	168	167	109	124	65	767
Fæces for helminthiasis...	79	140	297	266	291	199	150	1422
Fæces for dysentery, typhoid, &c.	7	11	46	25	9	8	5	111
Blood smears	33	156	164	148	76	69	43	689
Pus	3	15	20	11	13	6	5	73
Urines	11	16	65	31	52	19	11	205
Sputa	12	28	42	27	35	33	18	195
Tissues for section	7	59	37	13	66	11	10	203
Water analyses	7	10	9	12	9	12	4	63
Special autopsies	3	22	35	14	20	13	6	113
Rats dissected for plague	19	120	505	665	494	327	170	2300
Miscellaneous	29	82	133	76	59	47	45	471
Totals	243	760	1521	1455	1233	868	532	6612

Table II.

Numbers of blood specimens examined by Widal's reaction for Enteric Fever, with results month by month, and for whole period of six months.

Month.	Positive.	Negative.	Doubtful.	Total.
March 21st—31st	15	16	2	33
April	34	57	10	101
May	60	104	4	168
June	89	73	5	167
July	39	60	10	109
August	42	69	13	124
September 1st—20th ...	27	35	3	65
Totals	306	414	47	767

Table III.

Numbers of Widal examinations made of blood sent up from Kingston and the Public General Hospital, with percentage results month by month, and for the whole period.

Month.	Total Numbers.	Percentage Positive.	Percentage Negative.	Percentage Doubtful.
March 21st—31st	21	38·09	52·39	9·52
April	68	30·88	57·36	11·76
May	119	33·61	63·03	3·36
June	109	54·12	43·13	2·75
July	62	30·64	64·52	4·84
August	65	30·77	55·39	13·84
September 1st—20th ...	38	36·84	60·53	2·63
Whole period...	482	37·55	56·22	6·23

Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

Table IV.

Districts from which blood has been sent for examination by Widal's reaction for Enteric Fever with results.

District.	Positive.	Negative.	Doubtful.	Total.
Kingston and Hospital ...	181	271	30	482
St. Andrew	15	30	1	46
Buff Bay	14	22	2	38
Port Antonio	13	17	3	33
Mandeville	12	9	1	22
Spanish Town	11	4	2	17
Lucea	11	5	—	16
Linstead	10	4	1	15
Montego Bay	6	6	1	13
St. Ann's Bay	5	4	1	10
Lionel Town	5	1	1	7
Plantain Garden River ...	4	10	1	15
Morant Bay	4	2	2	8
Port Maria	3	3	—	6
Chapelton	3	1	—	4
Annotto Bay	2	11	—	13
Richmond	2	3	—	5
Manchioneal	2	—	—	2
Old Harbour	1	2	—	3
Malvern	1	2	—	3
Brown's Town	1	1	—	2
May Pen	—	2	—	2
Grange Hill	—	1	1	2
Alexandria	—	1	—	1
Black River	—	1	—	1
Newport	—	1	—	1
Totals	306	414	47	767
Percentages	39·89	53·97	6·12	—

Table V.

Details of Helminthiasis in the various districts from which specimens have been sent to the Laboratory.

District.	Number Sent.	Negative.	Ankylostome only.	Ascaris only.	Trichocephalus only.	All three.	Ankyl. and Ascaris.	Ankyl. and Trichocephalus	Ascaris and Trichocephalus
Annotto Bay	34	1	22	0	0	0	9	2	0
Black River	100	22	17	5	16	11	9	14	6
Buff Bay	167	18	125	1	2	5	10	5	1
Chapelton	118	12	21	12	10	27	14	11	11
Croft's Hill	15	0	1	3	0	3	4	3	1
Falmouth	84	7	9	5	9	20	6	10	18
Kingston and Hospital	66	17	15	3	6	4	6	14	1
Linstead	97	4	10	3	9	37	11	18	5
Lionel Town	168	63	43	15	11	9	13	10	4
Mandeville	97	7	14	4	4	26	20	13	9
Montego Bay	120	29	37	3	7	21	11	8	4
Plantain Garden River	53	13	31	2	2	2	1	2	0
Port Maria	136	8	99	1	1	4	16	6	1
Spanish Town...	13	1	4	0	1	3	1	3	0
St. Ann's Bay...	86	5	5	6	6	36	9	12	7
St. Mary's Poor House	39	0	7	1	0	10	6	12	3
Others	29	5	7	4	3	7	3	0	0
Totals	1,422	212	467	68	87	225	149	143	71
Percentages on Positive Results ...	Number Positive 1,210	—	38·59	5·62	7·19	18·59	12·31	11·81	5·86

Appendix VIII.

REPORTS ON WORK CARRIED OUT IN COLONIAL LABORATORIES.

Table VI.

Showing the percentage of Helminthiasis and the relative frequency of the various ova in districts from which 100 *or more specimens were sent during the six months, March-September,* 1914.

District.	Helminthiasis.	Ankylostome alone.	Ankyl. alone and in combination.	Ascaris alone.	Ascaris alone and in combination.	Trichocephalus alone.	Tricho. alone and in combination.
Black River	78	21·79	65·38	6·41	39·74	20·51	60·25
Buff Bay	89·22	83·89	97·31	0·67	11·41	1·34	8·45
Chapelton	89·83	19·81	68·87	11·32	60·36	9·43	55·66
Lionel Town ...	62·50	40·95	71·43	14·28	39·04	10·47	32·38
Montego Bay ...	75·83	40·66	84.61	3·29	42·85	7·69	43·95
Port Maria	94·91	77·34	97·65	0·78	17·18	0·78	9·37
Whole Island ...	85·09	38·59	81·32	5·62	42·39	7·19	43·47

Table VII.

Results of Agglutination Tests of Sera of Cattle with Bang's Bacillus abortus.

± Implies agglutination but incomplete, several bacteris remaining isolated; see page 239.

Name of Animal.	Dilution 1 : 100	Dilution 1 : 200	Dilution 1 : 500
1. "Blossom"	+	+	—
2. "Rosa"	±	±	±
3. "Lydia"	+	—	—
4. "Dainty"	+	+	+
5. "Brownie"	—	—	—
6. "Duchess"	—	—	—
7. "Grey"	—	—	—
8. "Brisk"	+	+	+
9. "Pretty"	—	—	—
10. "Butterfly"	+	—	—
11. "Gena"	+	±	—
12. "Pansy"	—	—	—
13. "Gloria"	—	—	—
14. "Bee"	+	±	±
15. "Honeybelle"	+	+	+
16. "Sophie"	+	+	+
17. "Janetstein"	+	+	+
18. "Priceless"	—	—	—
19. "Timora"	+	+	+
20. "Queen of Diamonds"	—	—	—
21. "Sunshine"	+	+	+
22. "Ethel"	±	—	—
23. "Abdullah"	—	—	—
24. "Pear"	+	+	±
25. "Betty"	+	+	±

TABLE VIII.

Details of 100 *cases from which Bile Cultures were made for* Bacillus typhosus.

No.	Initials.	Sex.	Age in Years.	Enteric Fever.			Diagnosis.		Bile Culture.	
				Suspected.	Found post mortem.	Widal.	Clinical.	Found post mortem.	Typhosus.	Others.
1 ...	R. C.	F.	8	Yes	Yes	+	Enteric fever.	Enteric fever.	+	—
2 ...	E. C.	M.	54	No	No	...	Fractured ribs.	Also ruptured spleen and liver.	—	—
3 ...	A. G.	M.	38	No	No	...	Sarcoma, left kidney.	Double cystic kidney, L.5,610, R.2, 250 grms.	—	—
4 ...	M. H.	F.	21	No	Yes	—	Pneumonia, left.	Typhoid ulcers.	+	—
5 ...	A. T.	M.	27	No	Yes	...	Pneumonia.	Typhoid ulcers very numerous; 5 in appendix.	+	—
6 ...	L. A.	F.	40	No	No	—	Enteritis.	Tuberculosis, lungs, spleen, intestine.	—	—
7 ...	C. C.	M.	48	No	No	...	Arsenical poisoning (suicidal).	Irritant poisoning, 431 grs. ars. acid.	+	—
8 ...	J. F.	M.	31	No	No	...	None made.	Pulmonary tuberculosis.	—	—
9 ...	Q. W.	M.	?	No	Yes	...	Pneumonia.	Typhoid ulcers; old pleuritic adhesions.	+	Coli.
10 ...	R. S.	M.	22	No	Yes	...	General peritonitis.	Peritonitis from typhoid perforation.	+	,,
11 ...	A. N.	F.	25	No	No	...	Phthisis.	Tuberculosis lungs and spleen.	—	Streptococci.
12 ...	C. F.	M.	41	No	No	...	None made.	Colitis.	—	—
13 ...	A. F.	M.	43	No	No	...	Dysentery.	Large intestine gangrenous, mitral regurgitations, renal infarcts.	—	Shiga type.
14 ...	I. S.	F.	28	No	No	...	Mitral regurgitation.	Mitral disease.	—	—
15 ...	Z. S.	M.	51	No	No	...	Liver abscess.	Confirmed.	—	Coli.
16 ...	A. G.	F.	19	Yes	Yes	— too early	Enteric fever.	,,	+	—
17 ...	E. W.	F.	25	No	No	...	Phthisis.	,,	—	—
18 ...	S. D.	F.	25	No	No	...	None made.	Tuberculosis, left lung, small intestines.	—	—
19 ...	L. B.	F.	25	No	No	—	Phthisis.	Empyema, left; fibrino-purulent pericarditis.	—	—
20 ...	E. N.	F.	22	No	No	...	None made.	Mitral disease.	—	—
21 ...	R. C.	M.	?	No	No	...	Chronic nephritis.	Confirmed.	—	—
22 ...	E. P.	F.	21	Yes	Yes	+	Enteric fever.	,,	+	—
23 ...	L. G.	M.	34	Yes	Yes	+	,,	,,	+	—
24 ...	A. W.	M.	53	No	No	...	Chronic nephritis.	,,	—	—
25 ...	G. M.	F.	$\frac{7}{12}$	No	No	...	Congenital syphilis.	,,	—	—
26 ...	J. M.	M.	30	No	No	—	Subtertian malaria.	,,	—	—
27 ...	P. M.	M.	49	No	No	...	Urethral stricture.	Chronic nephritis; right lobar pneumonia.	—	—
28 ...	M. H.	F.	40	No	No	...	None made.	Mitral incompetence.	—	—
29 ...	M. M'C.	F.	?	No	No	...	Nephritis and cardiac.	Confirmed.	—	—
30 ...	E. R.	F.	19	Yes	Yes	+	Enteric fever.	,,	+	—
31 ...	V. W.	M.	12	No	No	...	"Vomiting sickness."	Tubercular enteritis and peritonitis.	—	Coli.
32 ...	E. J.	M.	19	Yes	No	—	None made.	Phthisis.	—	—
33 ...	M. M.	F.	24	Yes	Yes	+	Enteric fever.	Confirmed.	—	—

TABLE VIII.—(*continued.*)

No.	Initials.	Sex.	Age in Years.	Enteric Fever.			Diagnosis.		Bile Culture.	
				Suspected.	Found post mortem.	Widal.	Clinical.	Found post mortem.	Typhosus.	Others.
34 ...	B.	F.	21	No	No	...	Phthisis.	Liver abscesses, gall stone ulcerated into duodenum.	+	—
35 ...	K. C.	F.	20	Yes	Yes	+	Enteric fever.	Confirmed.	+	—
36 ...	J. S.	M.	21	No	No	...	Pernicious anæmia.	Gangrenous appendicitis.	—	—
37 ...	A. B.	F.	46	No	No	...	Lipoma left groin.	Richter's hernia strangulation.	—	—
38 ...	V. C.	M.	20	Yes	Yes	+	Enteric fever.	Confirmed.		—
39 ...	A. S.	F.	29	No	No	...	Pneumonia.	Tuberculous broncho-pneumonia.	—	—
40 ...	G. T.	M.	33	No	No	...	Extravasation of urine.	Confirmed.	—	Coli.
41 ...	E. G.	F.	12	Yes	No	+	Enteric fever.	Broncho-pneumonia ; ? typhoid.	—	—
42 ...	F. R.	M.	40	No	No	...	Epithelioma of penis.	Confirmed.	—	—
43 ...	M. B.	F.	14	Yes	Yes	Indefinite	Enteric fever.	„	+	—
44 ...	W. S.	M.	16	Yes	? Old pigmented Peyer's patches	+	„	Tuberculosis pleura, pericardium and bronchial glands.	—	—
45 ...	R. J.	M.	23	Yes	Yes	+	„	Confirmed.	+	—
46 ...	A. J.	F.	5	No	No	—	Meningitis.	Abscess of lung pyopneumothorax.	—	Streptococci.
47 ...	J. J.	M.	40	No	No	...	Phthisis.	Confirmed.	—	—
48 ...	A. F.	F.	20	Yes	Yes	+	Enteric fever.	„	—	—
49 ...	A. McM.	M.	7	No	No	...	Tuberculosis of lungs.	„	—	—
50 ...	V. H.	F.	15	Yes	Yes	+	Enteric fever.	„	+	—
51 ...	C. G.	M.	46	No	No	...	Stricture and chronic nephritis.	„	—	Coli and streptococcus.
52 ...	A. T.	M.	14	No	No	...	Dysentery.	„ (amœbic).	—	Streptococci.
53 ...	S. H.	F.	42	No	No	...	Carcinoma uterus.	„	—	—
54 ...	F. P.	M.	60	No	No	...	Cystitis.	With enlarged prostate.	—	—
55 ...	A. F.	F.	24	Yes	No	—	Enteritis.	Phthisis, and ankylostomiasis.	—	—
56 ...	J. M.	F.	17	Yes	Yes	—	Not made.	Typhoid ulcers, early stage.	+	—
57 ...	M. B.	F.	16	No	No	—	Double pneumonia.	Right pyosalpinx, septicæmia, embolic pulmonary abscesses.	—	—
58 ...	N. N.	F.	41	No	No	...	Sarcoma upper jaw.	Confirmed.	—	—
59 ...	J. S.	M.	?	No	No	...	Uræmia.	„ Contracted granular kidney.	—	—
60 ...	J. W.	M.	20	Yes	Yes	+	Enteric fever.	„	+	—
61 ...	A. D.	F.	15	No	No	...	Not made.	Tuberculosis, lungs and intestine.	—	—
62 ...	L. G.	M.	$2\frac{3}{4}$	No	No	...	Enteritis.	Confirmed.	—	Sach's aërogenes.
63 ...	W. S.	F.	30	No	No	...	Intestinal obstruction.	Band from old appendicitis.	—	—
64 ...	J. B.	M.	10	Yes	Yes	+	Enteric fever.	Confirmed.	—	Coli only.
65 ...	J. D.	M.	64	No	No	...	Cellulitis of hand.	„ also mitral disease.	—	—

TABLE VIII.—(*continued*).

No.	Initials.	Sex.	Age in Years.	Enteric Fever.			Diagnosis.		Bile Culture.	
				Suspected.	Found post mort m.	Widal.	Clinical.	Found post mortem.	Typhosus.	Others.
66 ...	J. C.	M.	24	No	No	...	Acute pneumonia.	Confirmed.	—	Coli.
67 ...	R. J.	F.	11	Yes	Yes	+	Enteric fever.	,,	+	—
68 ...	Rb. T.	F.	19	Yes	Yes	...	,,	,,	—	—
69 ...	E. J.	F.	21	Yes	No	—	Not made.	General tuberculosis, lungs, peritoneum, pleura, liver, intestines.	—	Streptococci.
70 ...	E. B.	F.	22	No	No	...	Puerperal septicæmia.	Confirmed.	—	Streptococci and coli.
71 ...	A. McN.	M.	22	Yes	Yes	+	Enteric fever.	,,	—	—
72 ...	S. Y.	M.	40	No	No	...	Arsenic poisoning (suicide).	,,	—	—
73 ...	S. D.	M.	19	No	No	—	Lobar pneumonia.	,,	+	—
74 ...	A. C.	F.	30	Yes	No	—	Not made.	Colitis, ? dysenteric.	—	Coli.
75 ...	Not known	M.	?	No	No	...	,,	Cerebral hæmorrhage.	—	—
76 ...	J. B.	M.	40	No	No	...	Pneumonia.	Confirmed.	—	—
77 ...	J. S.	F.	19	No	No	...	Mitral disease and phthisis.	,,	—	—
78 ...	L. S.	F.	50	No	No	—	Not made.	Malignant endocarditis, embolic pyæmia.	—	—
79 ...	J. R.	M.	30	No	No	—	,,	Tuberculosis, lungs and serous membranes.	—	—
80 ...	M. W.	F.	19	Yes	No	—	,,	Tuberculous lobar pneumonia.	—	—
81 ...	F. J.	F.	23	No	No	...	Pyæmia.	Confirmed.	—	Streptococci.
82 ...	J. J.	F.	17	Yes	No	—	Not made.	Large pale kidney, ? uræmia.	—	—
83 ...	W. A.	M.	48	No	No	...	,,	Phthisis.	—	—
84 ...	W. S.	M.	19	Yes	No	?	Enteric fever.	,,	—	Coli.
85 ...	J. P.	M.	? 25	No	No	—	Not made.	Glioma, right hemisphere.	—	—
86 ...	A. R.	F.	38	Yes	No	—	? Enteric fever.	Cirrhosis of liver, chronic intestinal nephritis.	—	Coli.
87 ...	W. B.	M.	72	No	No	...	Gangrene, leg.	Confirmed.	—	—
88 ...	J. B. L.	M.	35	No	Yes	...	Cerebral hæmorrhage.	Enteric fever.	+	—
89 ...	M. L.	F.	38	No	No	...	Fibroid uterus.	Also phthisis, and old pleura effusion, left.	—	—
90 ...	J. W.	M.	52	No	No	...	Cerebral hæmorrhage.	Cerebellar tumour.	—	—
91 ...	A. McG.	F.	62	No	No	...	Malignant disease.	Carcinoma of uterus and peritoneum.	—	—
92 ...	P. L.	F.	42	No	No	...	Intestinal obstruction.	Volvulus.	—	Coli.
93 ...	C. E.	F.	? 22	No	No	...	Peritonitis.	Confirmed; perforation of malignant growth of jejunum.	—	Morgan.
94 ...	D. B.	M.	20	Yes	No	—	Enteric fever.	Dysentery.	—	—
95 ...	J. M.	F.	26	No	No	...	Not made.	Fibroids, and early pregnant uterus. (Death from hæmorrhage.)	—	Coli.
96 ...	C. V.	M.	27	No	No	...	General peritonitis.	Confirmed; perforated duodenal ulcer.	—	—
97 ...	H. W.	F.	37	No	No	...	Pleural effusion.	Malignant growth right lung and pleura.	—	—
98 ...	S. H.	M.	2	No	Yes	...	Not made.	Enteric fever.	+	—
99 ...	A. G.	F.	19	No	Yes	...	Pneumonia.	Confirmed, but also enteric fever.	+	—
100 ...	J. B.	F.	19	No	No	...	Cerebral malaria.	Tuberculosis, lungs and bronchial glands.	—	—

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